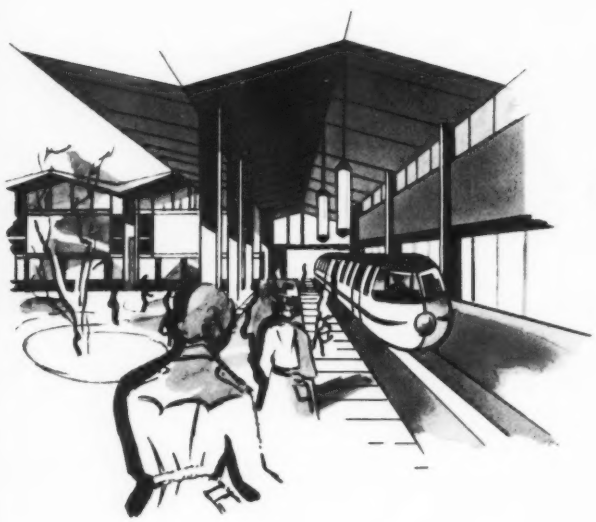
6 MARCH 1959

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



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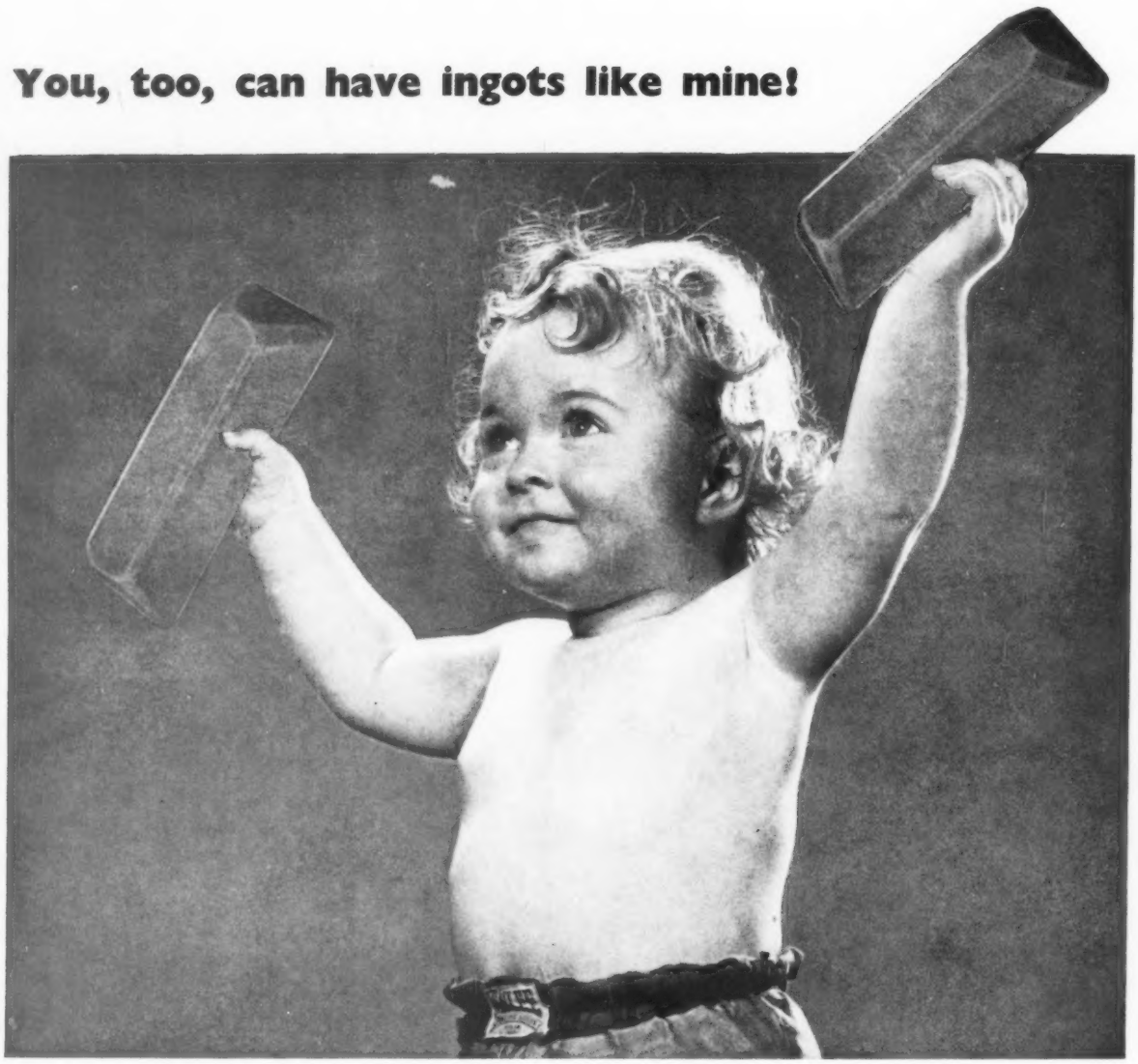

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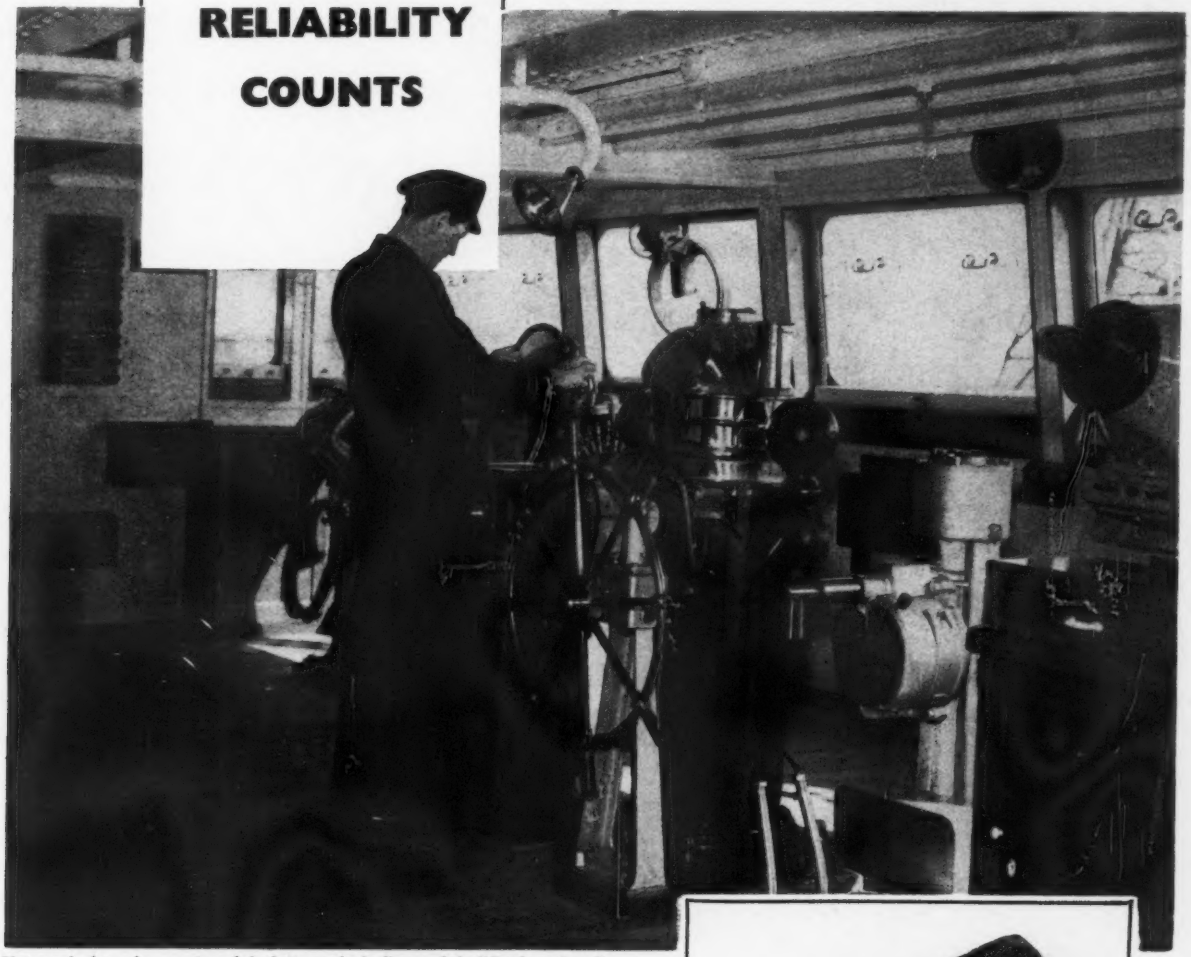

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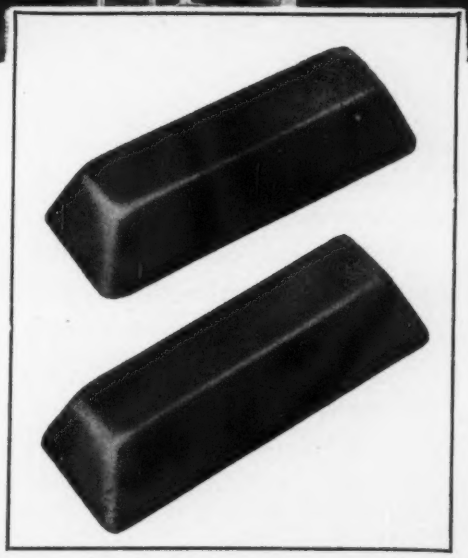

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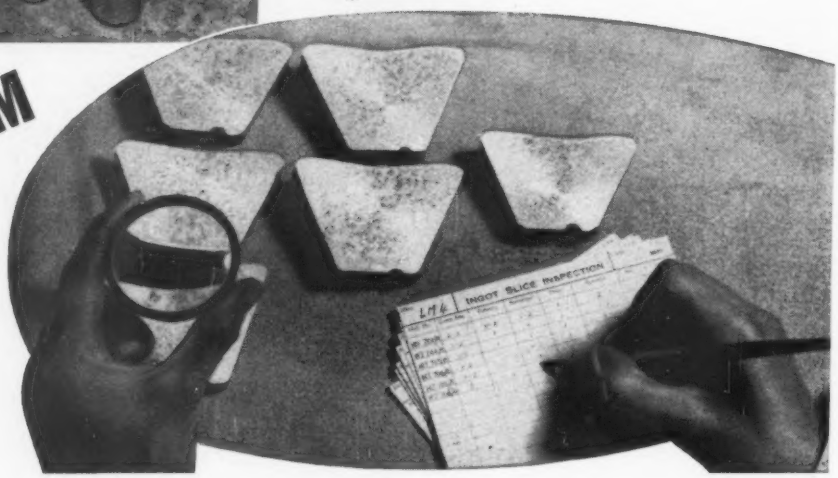

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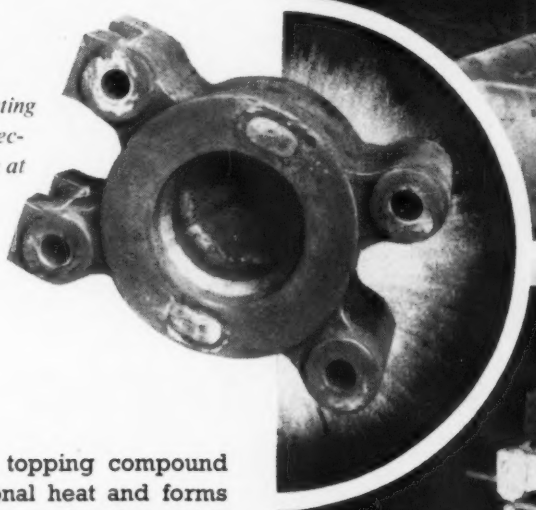
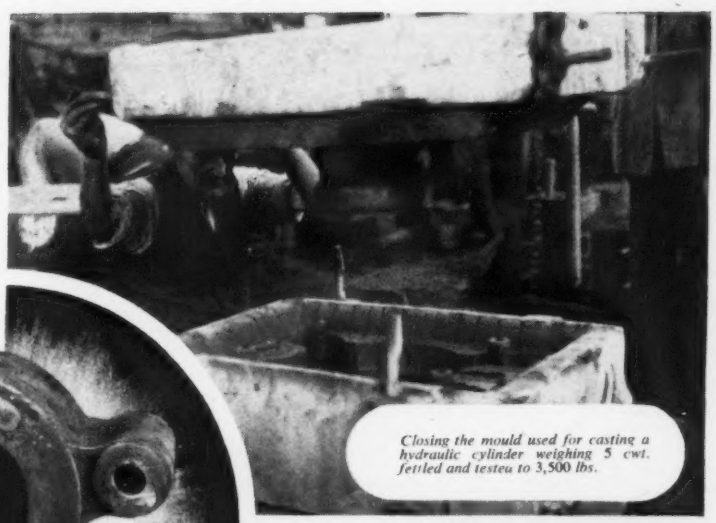
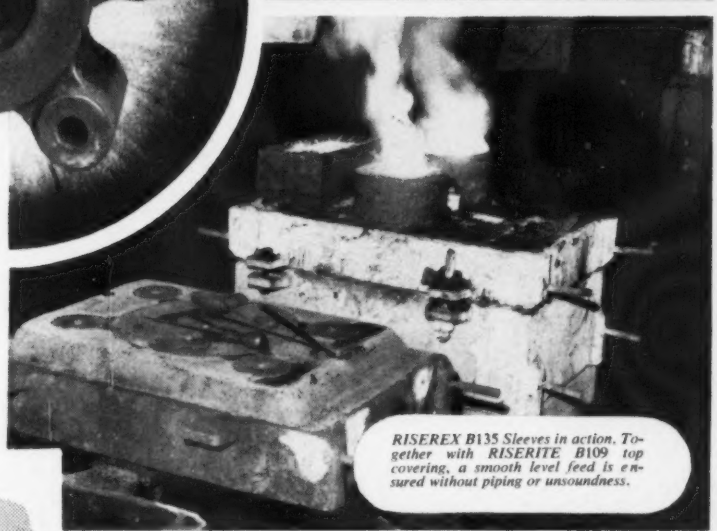


The fettled casting showing the solid sections and soundness at the base of the feeding heads.



Closing the mould used for casting a hydraulic cylinder weighing 5 cwt. fettled and tested to 3,500 lbs.



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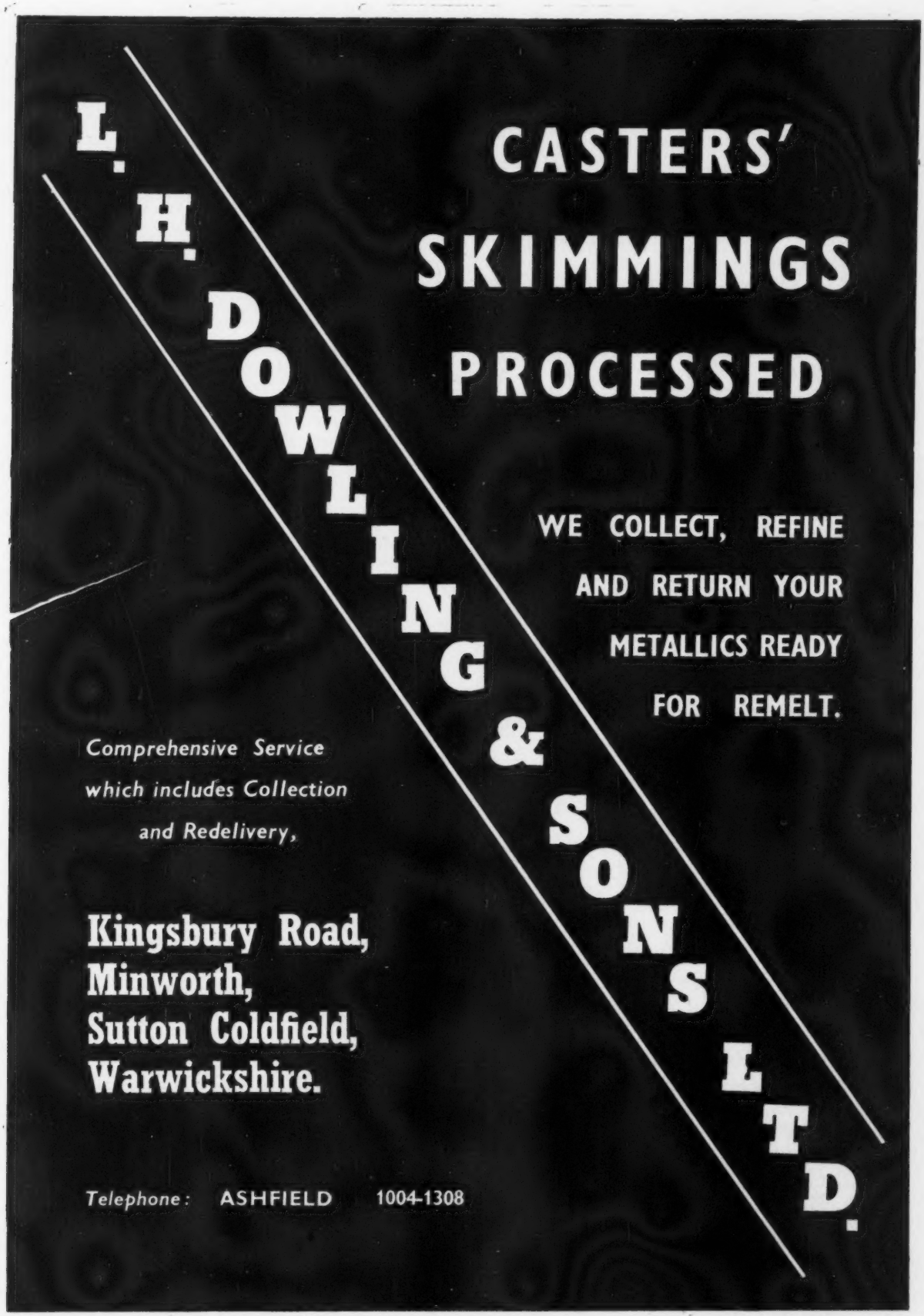
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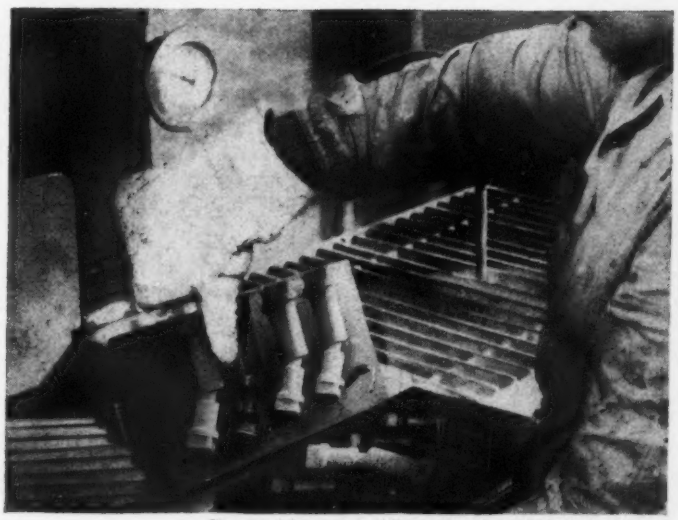

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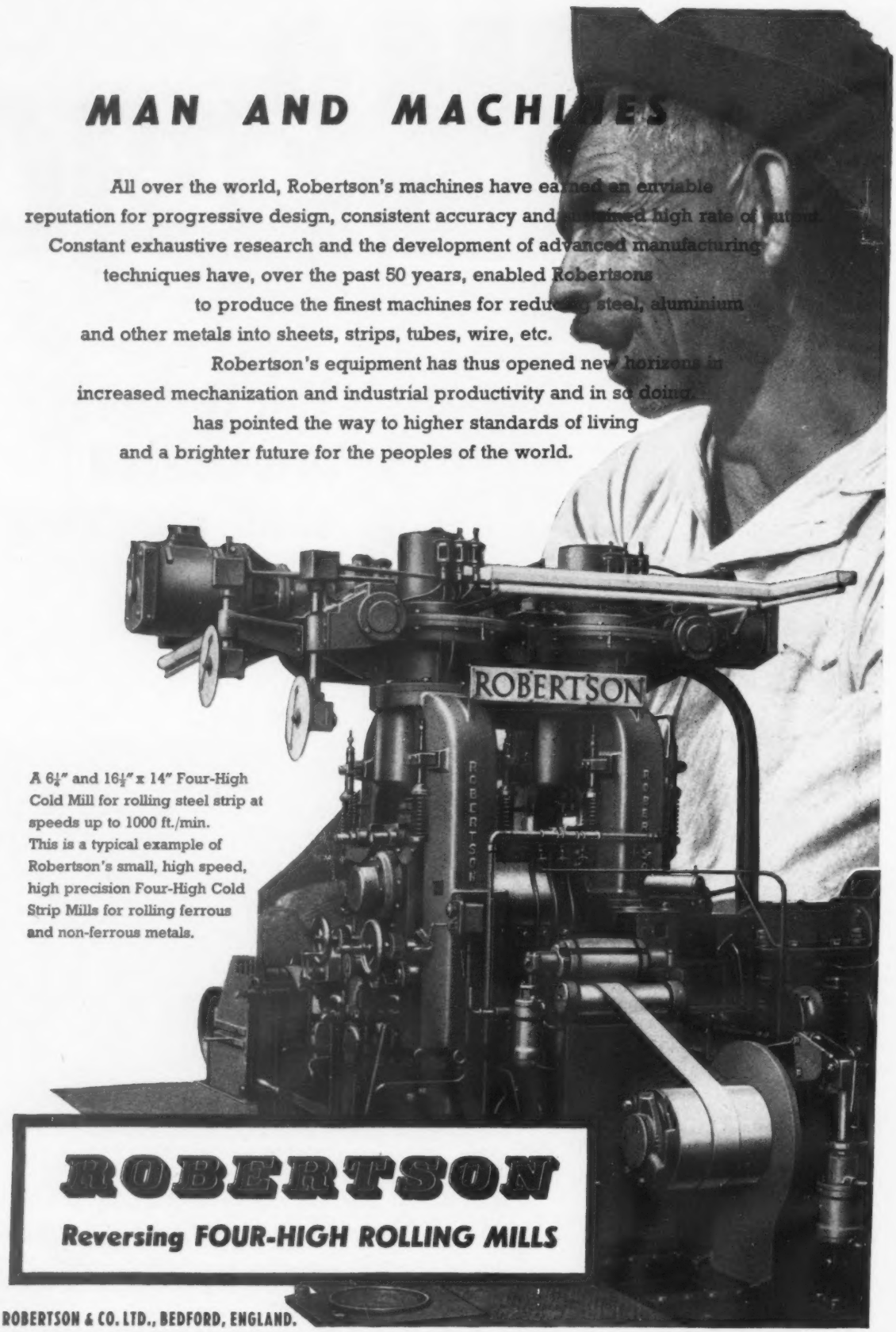

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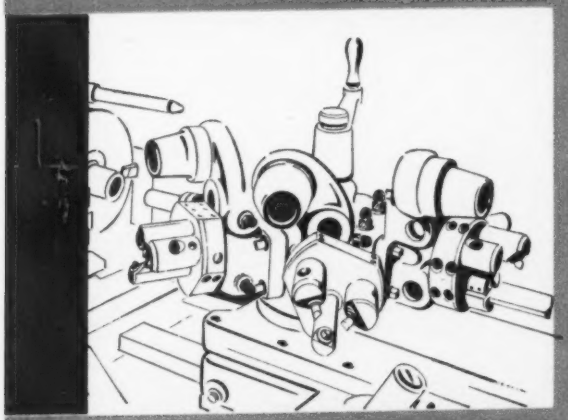

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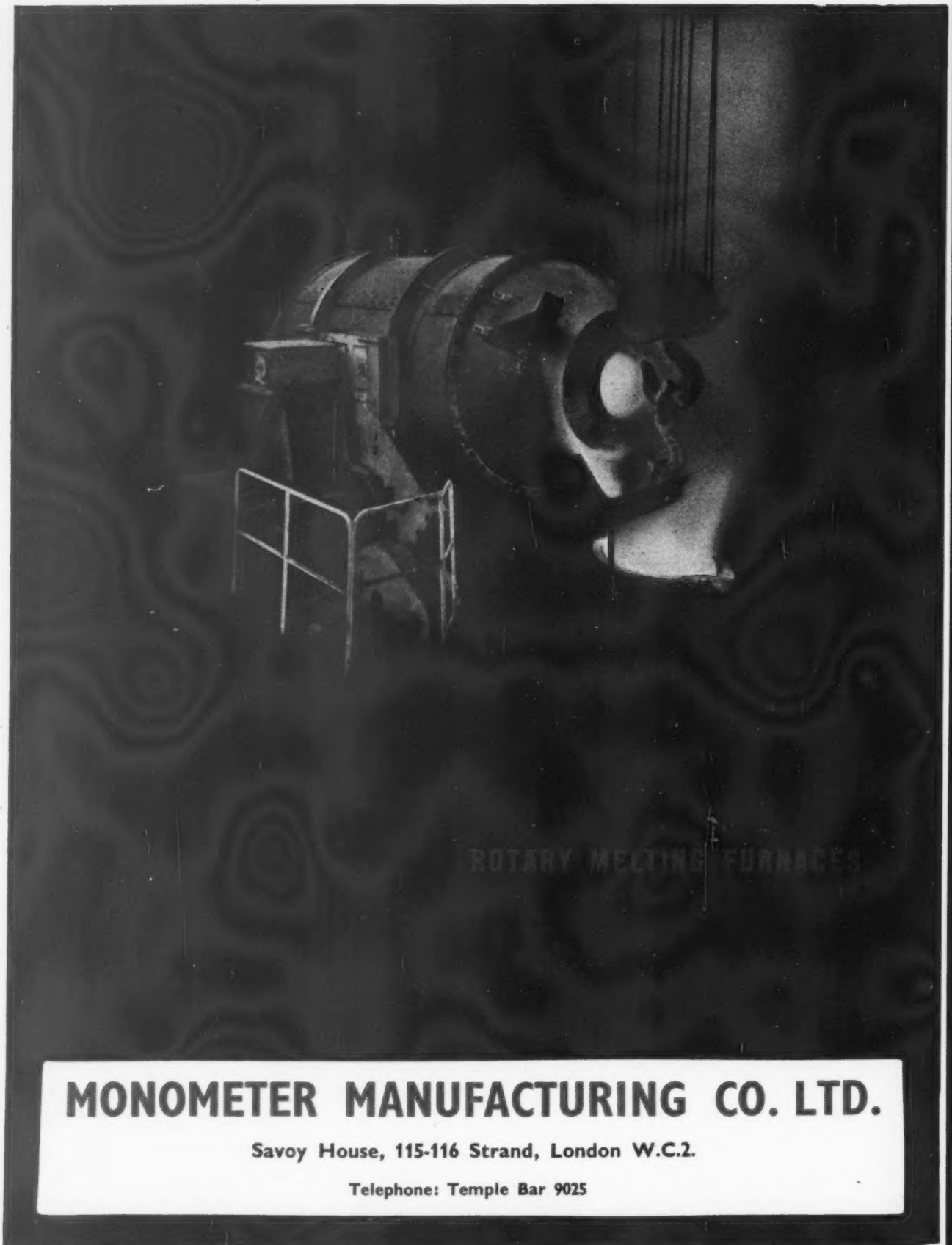

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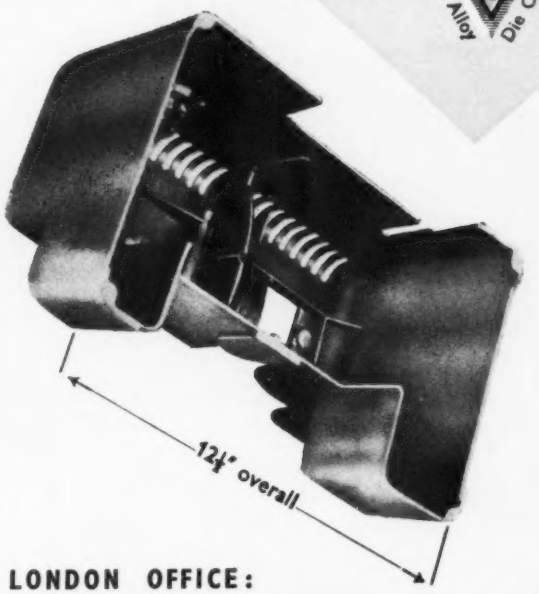

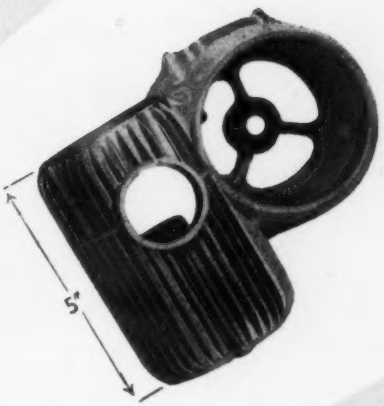

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FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

6 MARCH 1959 VOLUME 94 NUMBER 10

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Postgraduate Training

INTENDED to provide a training in methods of research for holders of good honours degrees or acceptable alternative qualifications, D.S.I.R. Research Studentships came into being during the first world war, although until a few years ago they went under the title of maintenance allowances. In 1922, only 156 were awarded in all; this year it is hoped to make nearly 800 new awards, after October the total number current is likely to be about 1,800, and in each of the next few years the number is to be increased annually by about 10 per cent to reflect the growing output of scientists and technologists.

It is, perhaps, only natural that the universities take up a large proportion of these grants. The attractions of the universities for the academically brilliant are very strong and, in consequence, a large proportion of all students suited to postgraduate research is likely always to come from them, and also to wish to receive postgraduate training there. No doubt one of the major attractions is the Ph.D. degree which the university can offer to its internal students. Other establishments specializing in certain branches of technology and science (for example, many technological institutions, the research associations and the establishments of the D.S.I.R. itself) can offer equally valuable research training but no doctorate as a hall-mark of success in this training, except to the London graduate able to work for his Ph.D. externally.

Commenting on this in an address to the Association of Technical Institutions, Sir Harry Melville, Secretary of the Department of Scientific and Industrial Research, pointed out that in 1922 the number of D.S.I.R. awards for tenure in technical colleges was greater than in 1956; in the former year the technical colleges taking up nearly 10 per cent of the awards available, a figure which dropped to about 1 per cent during the 1930s, but which last year rose to nearly 7 per cent. In Sir Harry's opinion, far too many of the better research students seek their postgraduate training in the universities, the Ph.D. degree providing an attraction which is distorting the distribution of research students in ways that are not in the nation's interests. It remains to be seen whether the newly-created Hives research qualification of "Membership of the College of Technologists" will provide an award as popular as the Ph.D.

In the meantime, it is essential that students should be encouraged to take their research qualifications in a wider range of institutions than at present. Every effort should be made by technical institutions to attract research students of such calibre as to qualify for the awards available. In this connection it should be emphasized that applications for awards from technical colleges are treated just as sympathetically as those from universities, and that a candidate for a research studentship need not necessarily hold a good honours degree; alternative qualifications can be accepted, including the new Diploma in Technology. Further, in 1957, a D.S.I.R. studentship intended to maintain students taking postgraduate courses of instruction other than in methods of research was awarded for the first time. So far very few technical institutions have taken advantage of the new scheme; again, lack of a well-known hall-mark at the completion of the course is one of the contributory factors.

Out of the MELTING POT

Will Out

AMONG other things, the potentialities of extremely fine pyrophoric metal powders were mentioned here some time ago (this page, METAL INDUSTRY, 25 July, 1958, p. 66) in the hope of stirring up interest among users of metal powders with a view to their considering on-the-spot production and use of "fresh" metal powders instead of making use of supplies of well-tried and firmly-established grades of "stale" powders supplied by specialist manufacturers. One of the latter promptly squashed the suggestion of users producing their own powders. The users, for their part, failed, understandably enough, to develop an interest in using anything other than the well-tried and firmly-established grades they had been relying upon hitherto. And as for pyrophoric powders . . . . it now appears that, contrary to what might consequently have been expected, the above suggestion regarding pyrophoric metal powders is unlikely to remain a suggestion indefinitely. This conclusion derives from the news that, in America, the National Research Corporation has developed a process (at present still secret) for manufacturing ultra-fine metal powders, and that small trial quantities of the first of these—aluminium powder—are now being made available. Ultra-fine iron, nickel, cobalt, copper, zinc, and other metal powders will follow. The particles of the new aluminium powder are only one-thousandth the size of aluminium powder commonly available to-day. The latter has a particle size of 5 to 10 microns. The upper size limit of the new powder is only 0·1 microns, the average particle size being 0·03 microns (300Å) and the smallest, 0·005 microns (50Å). Under the electron microscope the dull black particles show up as spheroids. With a surface area of 750,000 cm^2/gm. the powder is highly reactive. To begin with, it is pyrophoric and is normally shipped and stored under a non-reactive hydrocarbon. Because of its reactivity, uses in chemical reactions, catalytic processes, and in high-energy fuel compositions are envisaged. Powder metallurgy is considered as a potential major user: the possibility of preparing exact alloy compositions by mixing the required constituents instead of using alloy powders, and the use of ultra-fine iron and nickel powders for magnetic materials, look particularly promising.

Specials

IN the degree of specialization attendant upon their development, different processes have varied a good deal, and in some the trend has been much less noticeable than in others. Fabrication of metals is a case in point. Despite continuous development, casting, rolling, extrusion, drawing, forging, pressing, stamping, deep drawing, spinning, and the rest, are still with us, and in spite of the more elaborate plant and equipment that are being used, they are still recognizable for what they are. In fact, being what they are, these various processes can become specialized only to a limited extent. Progress of specialization does not end there, however. Baulked by the individual processes such as casting, rolling, sheet metal working, etc., still remaining just that, specialization has now taken the course of arranging them in more and more specialized patterns. In this it has been aided and abetted by the interest and developments in that specialized specialization known as automation. Where, formerly, blanking, deep drawing and trimming were just metal working operations, linking them together in an automated set-up results in special adjustments in the individual processes and, to that extent, in a specialized assembly. Specialization has, of course, gone much farther than it has in the above all-too-elementary example. Just how far is shown by the really advanced example represented by a machine for producing aluminium beer cans which starts with aluminium ingots and turns out the finished cans. It does not much matter that such familiar operations as melting, casting (continuous strip), rolling, blanking out of the slugs, and impact extrusion are still there; they can no longer be considered apart from what is a highly-specialized process and machine for manufacturing aluminium cans. The literature will, no doubt, follow suit, and where in the past we may have had an admirable treatise on deep drawing or an article on impact extrusion, we may expect publications on ingot-to-product processes and machines for aluminium beer cans; and if for cans, why not for milk churns, kettles, saucepans, or aluminium window frames?

Puzzled

PRESS releases are not meant to puzzle. With this cardinal point in mind, I am prepared to ascribe this effect in the case of an apparent exception, to personal failings and idiosyncrasies rather than to the press release. These personal characteristics include a reasonably good memory, an interest in antecedents, a liking for tying up loose ends and linking up seemingly disconnected facts, and the opinion that, in this competitive world, achievement is not something that can be allowed just to happen but something that should be manifestly shown as happening, as, for example, by means of suitable accounts in the technical press. I was puzzled, therefore, when I found myself faced with a news item announcing that a 500-ton "Hypactor" cold extrusion press, manufactured by Fielding and Platt Limited, was being installed in Sao Paulo by Industria Yorkshire Do Brazil, the press being capable of a throughput of 300 extrusions per hour by the Crittall-Luxfer process, and on noting that an illustration of a "Hypactor" press accompanying the note had been published by courtesy of the British Aluminium Co. Ltd. In an attempt to solve the puzzle I guessed at the interpretation of the Industria Yorkshire Do Brazil combination. Then, recalling sundry patents granted some years ago to Fielding and Platt Limited and Crittall-Luxfer, it did not prove too difficult to add them up to cold extrusion and the "Hypactor" press. There followed the task of trying to remember whether such an adding up had ever been published, and finally, hoping that somebody will correct my memory, which I admit may be at fault in giving a negative answer. If this negative answer should be correct, I am still puzzled why this undoubted achievement has not been publicized previously.

Skimmer

THE INFLUENCE OF THE RECRYSTALLIZED PERIPHERAL ZONE

Hot Deformation of Aluminium Extrusions

By C. PANSERI and E. DI RUSSO

In this article, the authors describe work carried out at the Italian Light Metal Institute, on some of the factors affecting forgings and hot stampings produced from extruded blanks. This article appeared in "Alluminio" and has been specially translated for "Metal Industry."

EXTRUDED material which has been produced under the correct conditions is admirably suitable for subsequent forging and hot stamping operations. Nevertheless, extrusions sometimes possess faults which, on forging or stamping, could be serious because of the formation of internal and external defects, with a consequently high rejection rate.

One of the most common defects is an external annular zone of very coarse recrystallized grains which can be clearly differentiated from the very fine grained central zone of the extrusion. Alloys of the Al-Cu-Mg group in particular are often subject to this defect, which appears either during heat-treatment or else during preheating prior to further working in the as-extruded condition, if the preheating is carried out at high temperatures and for excessively long periods.

Recently at the Istituto Sperimentale Metalli Leggeri, Milan, stamping tests have been conducted on 30 mm. dia. extrusions of Avional 24 (3·5-5 Cu, 0·2-1·5 Mg, 0·2-1·5 Mn. up to 1 Si, bal. Al) in order to study the behaviour of this material during hot plastic deformation and to determine the effects of the presence of peripheral coarse grain.

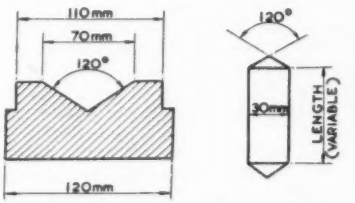


Fig. 1—Form of the specimen employed for the stamping test and section of one half of the die

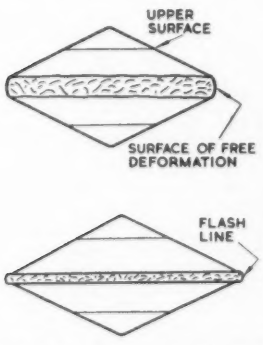


Fig. 2—Final shape assumed by the specimens, according to their initial height, L

The influence of the recrystallized periphery on the formation of cracks and superficial defects and on the extent of orange-peel has been studied by varying the following factors:— thickness of the peripheral layer, shape and size of the recrystallized grains and extent of deformation imposed. Specimens of the same alloy but without peripheral coarse grain were also subjected to the stamping test.

Experimental Procedure

Stamping tests were carried out on 30 mm. dia. specimens of various heights having conical ends with an angle of 120° at the apex. The design of the specimen and of the die employed are illustrated in Fig. 1. By using different specimen heights $L = 65$-90 mm.) variation in stamping behaviour could be determined for different amounts of deformation, that is, with different degrees of die-filling and eventually with the formation of a flash-line. Thus the initial height of the specimens determined the final form assumed after stamping, Fig. 2. During deformation the unrestricted surface or the surface of free deformation bulged slightly and the first fractures, which were attributed to tangential stresses, were observed on this surface.

While preparing specimens from the extruded rod for the stamping test, adjacent pieces were also removed for subsequent macrostructural examination of the material in the various conditions of heat-treatment in which it was to be tested.

Tests were carried out according to the following programme:—

(a) Preliminary heat-treatment of one batch of the specimens to obtain the formation of a peripheral recrystallized zone.

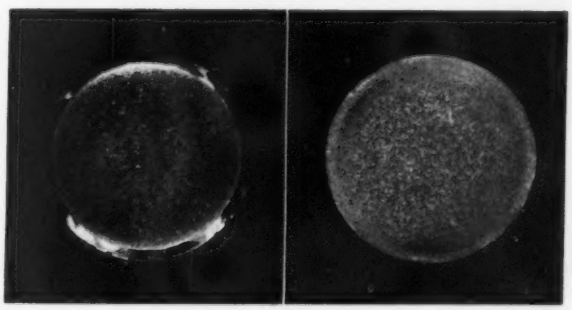
(b) Preheating of one batch of specimens in the as-extruded condition and another batch of specimens in the solution heat-treated and naturally aged condition.

(c) Stamping of the specimens.

(d) Heat-treatment of one batch of the stamped pieces by soaking at 495°C for 1 hr. and naturally ageing.

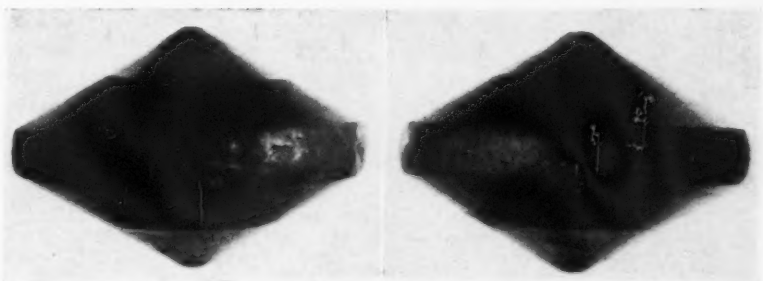
(e) Examination of the surfaces and of macrostructures of all specimens in the various conditions of work hardening and thermal treatment.

Forced circulation air furnaces were used throughout the experimental work



Right: Fig. 3—Macrostructures of two specimens 30 mm. in diameter. At left, solution heat-treated and naturally aged; right, reheated in the as-extruded condition for 1 hr. at 450°C. Etched in 20 per cent NaOH

Fig. 4—Appearance of the surface of free deformation of two specimens. At the time of stamping specimen T (left) had a recrystallized peripheral zone similar to that of the left-hand specimen in Fig. 3, whilst specimen P (right) had no recrystallized peripheral zone. (Fig. 3 right-hand specimen.)



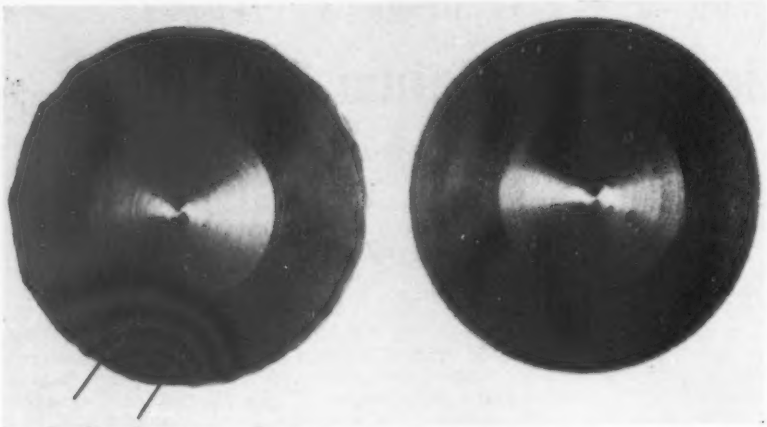


Fig. 5—Appearance of the upper surfaces of the two specimens reproduced in Fig. 4. The arrows indicate superficial cavities which are only present in specimen T.

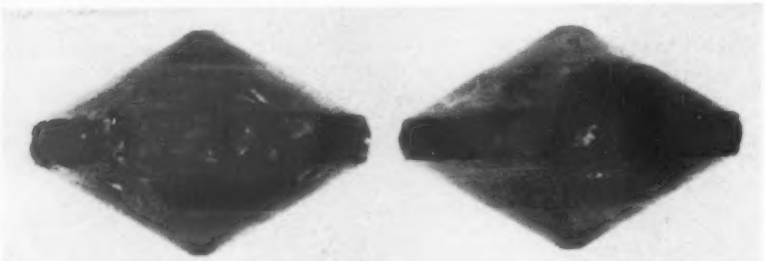
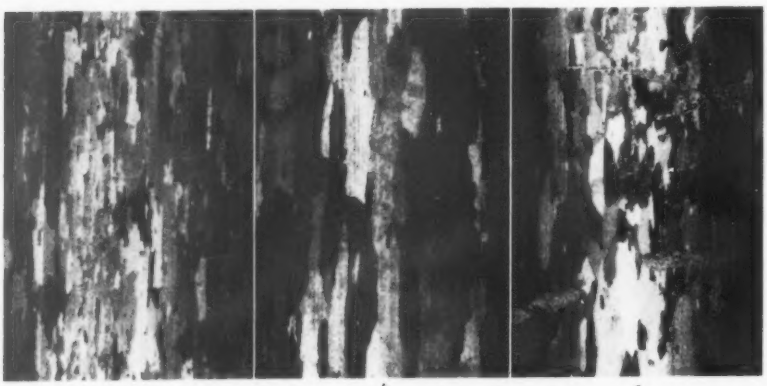


Fig. 6—Appearance of the external surface of two T specimens. Before stamping T_1 (left) had a recrystallized peripheral zone which was about three times the thickness of that of T_2 (right), whilst both specimens were of the same height. The surface grains of both specimens were of type b, Fig. 7



so that heating up of the comparatively small specimens occurred very rapidly and time at the desired temperature could be accurately fixed. Cooling on passing from furnace to press was considered negligible.

Tests were carried out on a stamping press, specimens being deformed in the direction of the axis corresponding to the extrusion direction. Deformation was completed by four blows of the hammer at equally spaced intervals of time.

As a means of identification specimens preheated in the solution heat-treated and naturally aged condition were marked *T* and those preheated in the as-extruded condition were marked *P*.

Results

Both *P* and *T* specimens were preheated for 1 hr. at 450°C before testing. Macrostructures of *T* specimens were not altered by these conditions but in some *P* specimens a thin recrystallized peripheral layer was formed.

The principal results may be subdivided according to the type of defect in the sample after stamping.

Surface Roughening (orange-peel)—In all *T* specimens, with heights (*L*, Fig. 1) of 65-80 mm. and with recrystallized peripheral layers of 0·5-8 mm. mean thickness, orange-peel was visible on the surface of free deformation (Figs. 3 and 4). For each initial height and, therefore, for each degree of deformation tested, surface roughening was independent, within certain limits, of the thickness of the original peripheral zone. With an initial height $L = 73$ mm. for example, the degree of surface roughening was practically the same for specimens with peripheral zones of from 2 mm. to 8 mm. in thickness.

P specimens which usually had no peripheral recrystallized layer had a perfectly smooth external surface after stamping (Fig. 4) for all degrees of deformation suffered.

Surface Discontinuities—In *T* specimens, irrespective of the shape and size of the peripheral recrystallized grains, small elongated cavities converging towards the apex of the specimens (Fig. 5) were present after stamping on the surfaces in direct contact with the walls of the die. These surface discontinuities, which were caused by an irregular flowing of the recrystallized grains, diminished in extent with decrease in thickness of the peripheral zone and with increase in the initial length of the specimens, i.e. with increase in deformation suffered. The

Above left: Fig. 7—In the macrostructures a, b and c, the surface crystals of the T specimens are very elongated in the extrusion direction. Figs. 7 and 8 were etched in 20 per cent NaOH. (× 3 approx.)

Left: Fig. 8—In the macrostructures d and e the crystals are finer; passing from macrostructure a to that of e there is a progressive improvement in stamping properties of the extrusion. Etched in 20 per cent NaOH

latter seemingly illogical phenomenon can be explained if it is borne in mind that the cavities are due to an irregular flow of grains, and not to an actual separation of the grains. By increasing the degree of deformation the surface of the piece suffers greater pressure and, therefore, becomes more smooth.

For *T* specimens with equal deformation and peripheral zones of equal thickness the cavities generally became more pronounced as grain size increased, and as the crystals became more elongated in the extrusion direction.

Cracking and Fissuring of the Surface of Free Deformation—On the basis of results of numerous tests conducted on *T* specimens, with lengths of between 65 and 80 mm. and which, therefore, did not completely fill the die on completion of the stamping operation, it was apparent that with equal deformation, the probability of cracking increased with increase in thickness of the peripheral coarse-grained zone (Fig. 6). Moreover, with equal deformation and equal thickness of the recrystallized peripheral zone the behaviour of the extrusion varied markedly with the size and shape of the grains which constituted the periphery.

The macrostructures depicted in Figs. 7 and 8 are those of the original external surfaces of the specimens subjected to the stamping test. In some specimens the superficial grains were markedly elongated in the extrusion direction (types *a*, *b* and *c*); in others, they had a more regular polygonal form and were smaller (type *d*); in others, the grains were so fine that they were irresolvable by the unaided eye (type *e*). These observations apply only to the two dimensions of the grains revealed by examination of the surfaces, and in order to determine the thickness of the crystals, macrostructural examinations were carried out on longitudinal sections.

Irrespective of type of peripheral grain, all the specimens had a macrostructure characterized by the following three zones:—

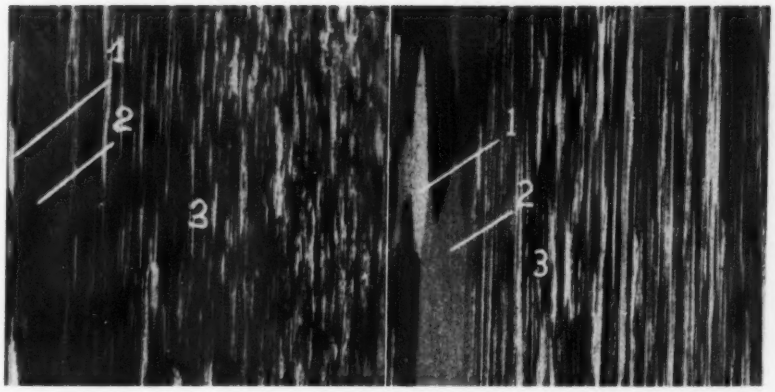
Zone 1. A very thin layer of thin plate-like grains at the surface.

Zone 2. A peripheral zone of coarse grains.

Zone 3. A central zone with a fibrous structure.

As indicated by Fig. 9, which illustrates two of such macrostructures (type *a* and type *e*), zone 1 was always very thin and zone 2 appeared in every case to be composed of very large grains elongated in the extrusion direction. From the stamping tests, it was possible to establish that the peripheral recrystallized layer favoured the formation of cracks when the outer grains of the periphery had a type *a* structure (narrow elongated grains) and that structures of type *b* (very elongated and much larger than *a*) were decidedly unfavourable.

When the external structure was of type *e* or *d* (equiaxed grains), behaviour during the stamping test was improved,



a *e*

Fig. 9—Macrostructures of sections parallel to the extrusion direction of two T specimens with surface grains of type a and type e respectively. Etched in 20 per cent NaOH (× 3 approx.)

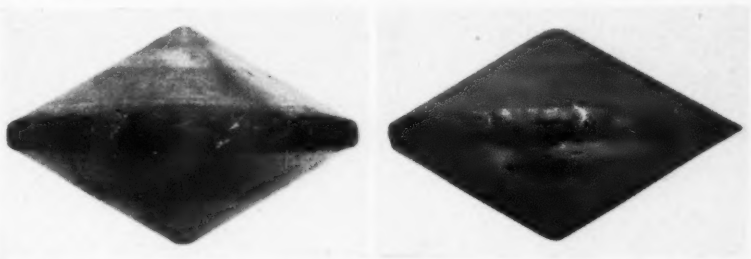


Fig. 10—Appearance of the external surface of two T specimens (L=73 mm.) thickness of the recrystallized periphery varied along the length of the specimen from 5 mm. to 2 mm. for T_1 (left) and from 2 mm. to 1·5 mm. for T_2 (right). Surface grains were of type a

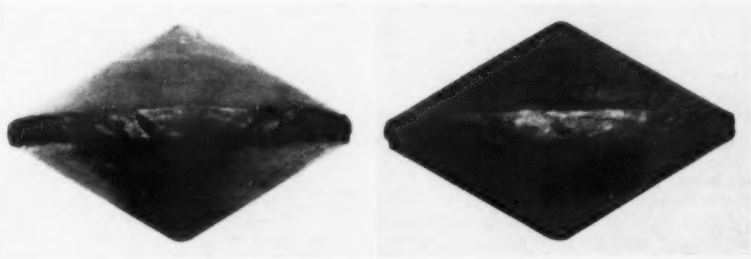
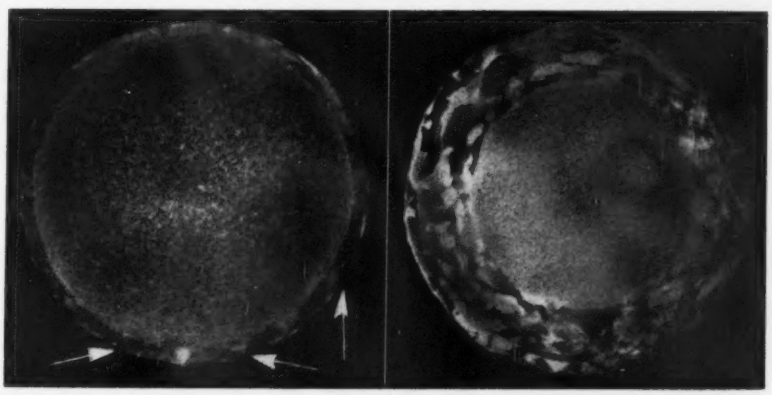


Fig. 11—Appearance of the external surface of two T specimens (L=73 mm.) thickness of the recrystallized periphery varied from 8 to 4 mm. along the length of specimen T_1 (left) whilst that in specimen T_2 (right) was ~2 mm. Surface grains were of type d

Fig. 12—Macrostructure of section transverse to the stamping direction and passing through the surface of free deformation of the two T_1 specimens reproduced in Figs. 10 and 11. Etched in 20 per cent NaOH. In the left-hand specimen the arrows indicate inter-crystalline cracking confined to the coarse-grained layer, whilst the right-hand specimen is sound



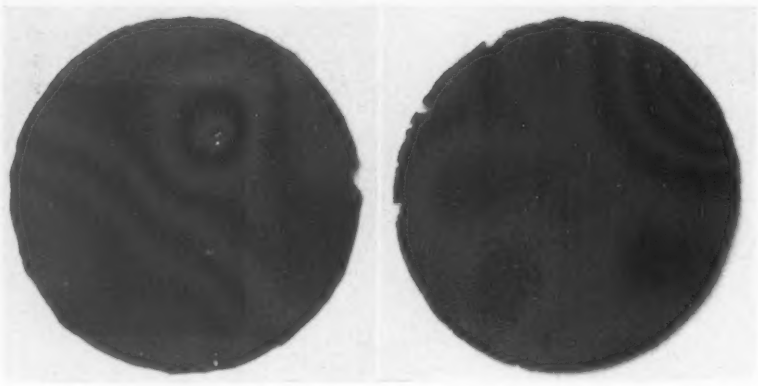


Fig. 13—Radiographs (positive) of two stamped T specimens affected by cracking, taken on sections normal to the stamping direction and passing through the surface of free deformation. They indicate that there are no internal defects

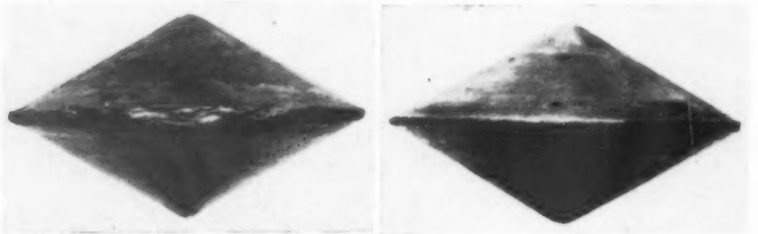


Fig. 14—Appearance of the external surface of the T specimens with fine equiaxed grains at the surface in the stage just before the material issues from the die (left-hand specimen) and after the formation of the flash-line (right-hand specimen)

compare the specimens illustrated in Fig. 10 (L=73 mm. original macrostructure type *a*) with those of Fig. 11 (L=73 mm. original macrostructure type *d*).

Structural examination of the stampings carried out on a section normal to the direction of pressing, and passing through the surface of free deformation, indicated that the cracking was confined to the coarse-grained layer and that it occurred mainly at the crystal boundaries (Fig 12 left-hand specimen). Radiographic examination of the same transverse section indicated that there was no internal damage.

None of the T specimens with an external structure of type *d* or *e*, with thickness of the peripheral zone of between 2 and 8 mm., showed cracking (Fig. 12, right-hand specimen), even when the die was almost completely filled. However, fissures occurred on the surface of free deformation of numerous specimens which originally had a pronounced recrystallized peripheral zone. Fissuring was considered to be due to shear stresses, whereas cracking was attributed to tangential stresses. When the thickness of the peripheral layer did not exceed 1 mm., increase in the degree of deformation did not alter markedly the appearance of the external free surface of deformation, nor did it affect the incidence of cracking even when the external grains had unfavourable elongated structures of type *a* or *b*.

The tests described above refer to specimens whose maximum deformation corresponded to almost complete filling of the die. T specimens of lengths which allowed the formation of a flash line (L=85-90 mm.) had, at the time of stamping, a peripheral zone varying between about 8 and 2 mm. with equiaxed grains at the surface of type *d* or *e* (Fig. 8). After stamping, no cracking was observed either on the flash-line or on the surface in contact with the walls of the die (Fig. 14, right-hand specimen) despite the fact that before the final blow of the hammer surface roughening, and in some instances even fissures, were observed (Fig. 14, left-hand specimen). However, on the surface layers of the stamping, at areas in contact with the outer edge of the die, there was a very small amount of overlapping of the material.

Conclusions

Preliminary stamping tests have been conducted on 30 mm. dia. Avional 24 extrusions using a double cone die, the conical bases having angles of 120° at the apexes. In studying the effects of coarse peripheral grain the following conclusions have been reached:—

(a) Depending on their original heights, specimens subjected to the stamping test can indicate either the tendency to form orange-peel or the tendency to form fissures and cracks on the surface of free deformation and superficial cavities in the zone which flows in contact with the walls of the die.

(b) The presence of the recrystallized layer favours the appearance of cracks, particularly when the outer grains of the recrystallized peripheral layer are in the form of thin plates elongated in the extrusion direction and only slightly spread in the transverse direction.

(c) The best behaviour during stamping in respect of both incidence of cracking and surface irregularities is obtained when the surface of the extrusion is composed of fine equiaxed grains, and is independent of the size of grains just below the surface and whether the latter are elongated in the extrusion direction.

(d) Whenever the specimens with fine equiaxed grains at the surface, and with a wide recrystallized peripheral layer, undergo heavy deformation leading to the formation of a flash-line, fissures may appear initially on the surface of free deformation. These disappear, however, after subsequent phases of the stamping operation, when the material issues from the die.

(e) No stamping defects or orange-peel were observed in the specimens tested in the as-extruded state, except when pre-heating at 450°C a thin recrystallized peripheral layer was formed.

The authors wish to thank G. Bedeschi, and Dr. D. Gualandi for their assistance in the experimental work.

Fatigue Strength of Plated Components

IN investigations into the effect of shot peening prior to electroplating on the fatigue properties of a modified S.A.E.3140 alloy steel, favourable results were obtained by the Physical Metallurgy Division of the Department of Mines and Technical Surveys, Ottawa.

Eight S-N curves were obtained on steel specimens with surface conditions as follows: as-machined, shot peened, electroplated on a machined surface, and electroplated on a shot peened surface. The curves showed that specimens shot peened prior to plating had materially higher fatigue properties. The improvement is illustrated by an examination of the number of cycles to failure obtained at a given stress (65,000 lb/in^2) in the damage zone:—machine finished specimens failed at 939,000 cycles, shot peened specimens were unbroken at 14,191,000 cycles, chromium plated specimens failed at 132,000 cycles, specimens shot peened prior to chromium plating remained unbroken at 13,443,000 cycles, nickel plated specimens failed at 139,000 cycles, specimens shot peened prior to nickel plating failed at 289,000 cycles, cadmium plated specimens failed at 98,000 cycles, and specimens that were shot peened and cadmium plated failed at 211,000 cycles.

New Plant & Equipment

Chlorination

AN instrument which combines a chlorinator with a flow recording instrument has been introduced by Chlorination Equipment Limited, 129 Kingsway, London, W.C.2. While saving space and avoiding trailing connections between the units, this results in an improvement in efficiency by eliminating losses that can occur from remote mounting of the recorder.

The recording unit is installed in the head of the equipment, and readings can be taken at a glance through a glass panel that opens to allow easy access to the unit without interfering with the chlorinator. The recorder operates from the metering differential, which is transmitted to coupled bellows, and is obtained by connections across a specially-designed valve inserted between the vacuum regulator outlet and the meter inlet. The vertical movement of the bellows coupling controls the pen-driving mechanism.

A continuous recording is provided on the seven-day drum chart, calibrated in lb/hr. of chlorine. The drum is operated by an eight-day clockwork mechanism.

The cabinet is made of polyester-impregnated glass fibre, and the most important components of the chlorinator, such as the injector block, chlorine regulator, valve body and piping, are made from plastics materials specially developed for their chlorine- and water-resisting properties. Corrosion-resistant alloys are used where metal parts are unavoidable.

To enable the operator to alter the capacity of the instrument, the chlorine flow meter and the control valve stem and sleeve assembly are situated in an easily accessible position, as, indeed, are all the major components.

This chlorinator is produced in two types:—type NMF for manual operation, and type NAF for fully automatic dosing, each type being available with 13 meter sizes, ranging from maximum capacities of 0·125 lb. to 40 lb. of chlorine per hr. with a control range of 10 to 1.

Bright Annealing

SHAKER hearth furnaces, arranged to be used with artificial atmospheres, are extremely useful for the bright hardening of carbon steels, and the bright annealing of ferrous and non-ferrous metals, such as pressings, stampings, and machine parts.

In a new design introduced by Hedin Ltd., Commerce Estate, South Woodford, London, E.18, a number of improvements are included. The shaker movement prevents flat components from jumping on top of one another, thus obviating inconsistency of heat-treatment. The charge passing through the furnace can be regulated according to its weight and nature by an infinitely variable speed unit. Further, the arrangement of the elements can be adjusted to suit varying weights of charge, and care has been taken to prevent the cooling, even of the lightest charge, while it is on its way to the quench.

The hearth is of cast nickel-chromium and can either be machined smooth or grooved to suit individual requirements. The hearth is housed in a gas-tight heat-resisting muffle, and is fitted with a water-cooled chute where it enters the oil quench to prevent heat conduction to the oil.

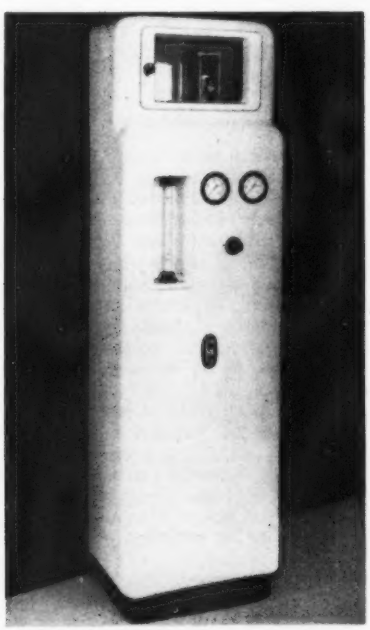
The standard model is rated at 18 kW and has a capacity of 50 lb/hr. The plant is supplied with a floor-mounted cubicle housing the electrical control gear. The quench tank can either be supplied fitted with work baskets or mechanized to bring the charge out of the quench.

Testing Coatings

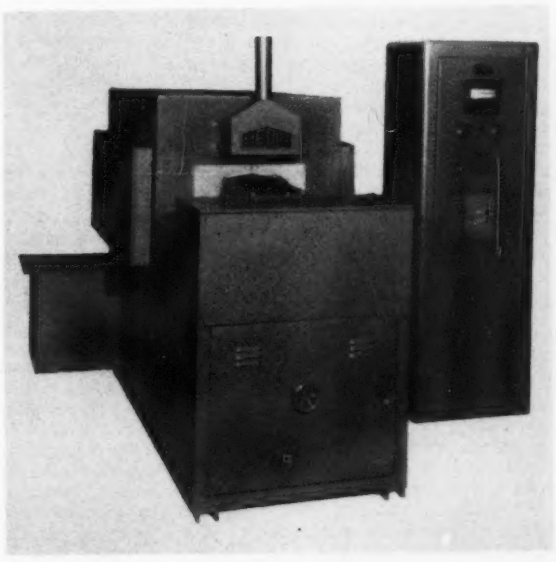
A FULLY-TRANSISTORIZED instrument to provide a source of high voltage for detecting imperfections in the insulating properties of protective materials applied to metal structures, has been designed and developed by P.A.M. Limited, Merrow, Guildford, Surrey, in conjunction with Cathodic Corrosion Control Limited. The latter company specializes in the technology associated with protection from corrosion; they are the sole distributors of the Holiday Detector.

Known as the Portable Holiday Detector, the instrument weighs approximately 17 lb. complete with batteries. In the form shown, the detector is contained with batteries in a strong plastics case. The overall dimensions are 11 in. by 9½ in. by 4½ in.

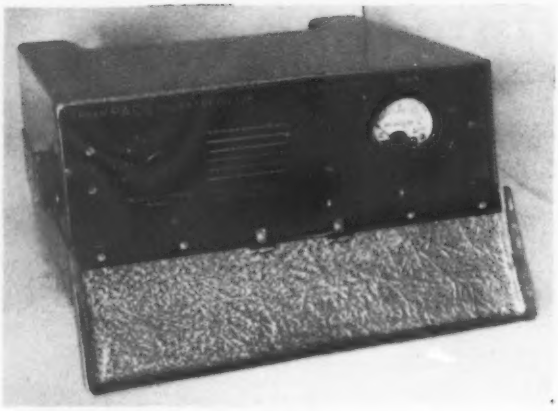
The output voltage is D.C. and of negative polarity, adjustable in eight fixed steps between 6 to 20 kV by means of a selector switch. Up to 500 micro-amps can be drawn from the unit at 16 kV. A built-in meter provides an accurate indication of the output voltage.



Left: The flow recording chlorinator introduced by Chlorination Equipment Limited



Right: The Hedin 18 kW shaker hearth furnace for bright annealing



Fully transistorized instrument — the Portable Holiday Detector, designed by P.A.M. Limited, to detect imperfections in insulated coatings

The input power is supplied by six 2-volt non-spill batteries, giving up to 12 hr. continuous operation. Various types of high voltage probes can be connected to the detector for different purposes to suit individual requirements. The presence of a crack or fault in the insulating material or coating under test, produces a loud penetrating note from a small built-in loudspeaker in the detector. The note varies according to the extent or character of the fault located.

The instrument can be pre-set to operate over the range from short circuit fault current down to a maximum sensitivity of 100 micro-amp representing leakage current.

In addition to the sound indicator, a specially designed controllable neon lamp indicator can be fitted to the electrode handle, covering the same range of leakage current from 100 micro-amp upwards. The unit thus can be used to indicate coating thickness as well as actual defects.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

Dislocations Observed

To the Editor of Metal Industry

SIR, — It seems a pity that "Skimmer," in his comments on "Dislocations Observed" in the issue of 30 January, should be unaware that published literature shows that this is a field in which British scientists have a lead of many years over the rest of the world.

In point of fact, dislocations were first observed in aluminium by P. B. Hirsch at the Cavendish Laboratory in Cambridge in March 1956, and a ciné film of their movement was obtained a few weeks later. In co-operation with W. Bollmon, of Battelle Institute, Geneva, a further film on dislocations movement in stainless steel was then made. Having established the presence of dislocations in aluminium, Hirsch and co-workers have now studied dislocations in stainless steel, copper, gold, silver, nickel and uranium and Brandon has investigated their behaviour in iron, Thomas and Whelan have found some interesting forms of dislocations in aluminium alloys, and Nicholson has studied the generation of dislocations during the transition from coherency to partial coherency at the interfaces during phase changes in the same alloys.

The actual disarrangement of the lattice surrounding a dislocation in a metal has been observed in the elegant work of Menter, Bassett and Pashley by examining the moiré patterns produced from overlapping metal foils.

During the past three years, a large body of knowledge on the preparation of thin metal foils for direct examination in the electron microscope has developed, whilst the complex theoretical treatment of the origins of the contrast observed in the electron optical images is rapidly being elucidated. In fact, the seeds of a complete revolution in metallography have been planted, and are rapidly sprouting.

Yours, etc.,

J. Nutting.

Department of Metallurgy,
University of Cambridge.

Uses of Lead

IN the series of leaflets issued by the Lead Development Association under the title "Applications of Lead" the the latest deals with lead sheet and pipe. These instructional leaflets are prepared in a non-technical manner for the use of students and readers not requiring detailed technical information. This publication, and the others in the series, which dealt with lead in cables, paints, batteries, atomic energy, and in solders, are all available free of charge from the Association at 18, Adam St. London, W.C.2.

Readers' Digest

ELECTRICITY

"Basic Electricity" (5 *parts*). *Published by The Technical Press Ltd., 1 Justice Walk, London, S.W.3 Price 12s. 6d. per part. 55s. 0d. complete.*

VISUAL aids have become an accepted method of conveying ideas and instruction; they frequently succeed where more formal texts create confusion. There are, it must be recognized, many people for whom electricity and its workings have remained a subject obscured by strange terms and units—megohms, ampere-hours, capacitance and so on. Even with the present-day emphasis on technical education it is still possible for a young man to enter industry with only a confused idea of the how, why and what of electricity. These books, adopting as far as possible a visual approach, set out to remedy this situation by reducing to the bare essentials the facts necessary to understand electrical systems. They originated in the need of the U.S. Navy to train electricians and instrument engineers rapidly, and the original scheme has been re-drafted for British and Commonwealth usage by a special Electronics Training Investigation Team of the R.E.M.E. In their revised form they will be used by R.E.M.E. to train, to electronics technician level, men starting with no knowledge of electricity at all.

Starting with an outline of electron theory, the first part deals with the production of electricity by friction, by chemical action, and by magnetism. It deals with current flow, magnetic fields, measurement of current, meters, E.M.F., voltage, resistance; all in the simplest possible manner, with innumerable cartoon-type diagrams designed to impress a single idea at a time on the reader's mind.

From the elementary subjects dealt with in Part 1, the student is led through discussion of such subjects as Ohms Law, electric power, A.C. and D.C. current, inductance, capacitance, series and parallel circuits via some typical instruments and machines, to electro-mechanical devices and a brief glance at electronics.

At the end of each part, a number of experiments are outlined, thus enabling the student to carry out practical demonstrations of the facts given. For conveying essentials and for rapid basic instruction, these books should prove valuable.

In addition to the normal bookshop edition a special "Schools and Industry" edition at 10s. 6d. per part (or 9s. 0d. each part if bought in sets) is being produced for sale to schools, colleges and industry where recognized training schemes are in operation.

A companion set of volumes on "Basic Electronics" which will follow the same lines as those reviewed here is shortly to be published.

Finishing Supplement

Hard Nickel Plating

By A. J. STEIGER

This article describes Russian work designed to improve the wear characteristics of plated calculating machine components, where normal chromium plated finishes had been found unsatisfactory. The investigations, which were described in "Metal Finishing" were originally reported in "Priborostroyeniye", the organ of the Russian instrument building industry. In the process described an oxalic acid electrolyte is used, and the deposit is claimed to be more than twice as hard as that from normal sulphate baths while giving faster deposition.

METAL finishing engineers in the U.S.S.R. have developed an electroplating process for producing a hard bright nickel deposit from oxalic acid electrolytes.

The process was developed by the Scientific Research Institute of the Russian Calculating Machine Industry in the course of experiments designed to improve on the chromium plating methods used, and found wanting, to get a good wear-resistant finish on profiled parts installed in electronic and electro-mechanical computers.

Finding chromium plating deficient, other metals and alloys were tried, such as iron-manganese-nickel and iron-nickel, but without effective results in plating machine parts having particularly complex profiles. The electroplating tests were made in sulphates of iron and nickel with an addition of ammonium oxalate.

Preliminary research established that, other conditions being equal, deposit hardness depended on the iron content of the electrolyte, being greatest when the latter was minimal. On this basis, an electrolyte was developed from nickel sulphate and ammonium oxalate, which does not contain any salts of iron.

In the oxalic acid electrolytes, the nickel is deposited five to six times faster than in ordinary sulphate baths, and is more than twice as hard.

The deposits of nickel formed in the oxalic acid electrolyte are marked by high-grade hardness and smoothness, requiring no additional polishing. It was observed that the tank material dissolving in the electrolyte often contributed to deterioration of the quality of electrolytic deposits. Tests showed that the most resistant tank material is stainless steel. Admixtures in the electrolytes also have a substantial effect on the quality of the electrolytic deposits of nickel. In an electrolyte composed of nickel sulphate and ammonium oxalate, the rate of deposition rises with increase in nickel sulphate concentration, but hardness of the deposit decreases. A nickel sulphate concentration of 140 gm/L is most satisfactory. The brightest and smoothest nickel deposits are obtained at a temperature of 70° to 80°C. (158° to 176°F.).

In a freshly-made solution of nickel sulphate and ammonium oxalate the *p*H is 6·2-6·8 with the quinhydrone electrode. The tests showed, however, that there is no direct dependence between the hardness of the cathode deposit and the electrolyte's acidity. The acidity has a very great effect on the rate of deposition; the higher the *p*H value, the faster is the rate of nickel deposition. At a constant *p*H value, the nickel deposition rate increases with increase in current density. It is most expedient to carry out the nickel deposition at a *p*H of 7·5-8, because at higher *p*H values the cathode efficiency diminishes.

At current densities of the order of 0·5 - 1 amp/dm^2, the deposits become quite dark and coarse. The appearance of the deposits is appreciably improved with increase in current density but, at 15 amp/dm^2, the deposits began to crack at the edges. However, the current density has little effect, in general, on the hardness of deposits. At a current density of 10 amp/dm^2 and *p*H of 7·5-8, the average cathode efficiency is 40-45 per cent. Under the same conditions, the anode current efficiency is 8-10 per cent lower than the cathode yield.

The throwing power depends, to a large extent, on current density, as Table I shows.

Raising the current density causes an increase in the coating's porosity as well. The pores of electrolytic nickel deposits formed in oxalic acid electrolytes have the character of a network of fissures. The porosity declines, however, with increase in the thickness of the deposit. The pores retain lubricant very well, it was noted.

At low current densities, the nickel deposits formed are black. This is caused by the inclusion of carbon in the composition of the cathode deposit. The carbon content in the deposit declines with the rise of the electrolyte's temperature, as is evident from Table II.

The carbon content was determined at a current density of 10 amp/dm^2 and *p*H 7·0.

At a temperature of 70°C. and various *p*H values, the relations in Table III exist between the current density and carbon content in the cathode deposit.

The carbon content in the deposit rises with increase of the ammonium oxalate concentration.

It was noted that the covering power of the baths is improved by the organic admixtures that are especially prepared for oxalic acid electrolytes by the Institute of Chemical Reagents. But these admixtures disintegrate very rapidly and, for this reason, their use was rejected. Among inorganic admixtures, ammonium fluoride and chloride cause some increase in the solubility of anodes; however, they impair the appearance of the deposits. Furthermore, the use of boric acid interferes with maintenance of *p*H values in the range of 7·5-8. The investigations thus showed that it was not expedient to introduce admixtures into the electrolyte.

The prolonged experiments carried out resulted in the adoption of the following electrolyte composition and

TABLE I—THROWING POWER

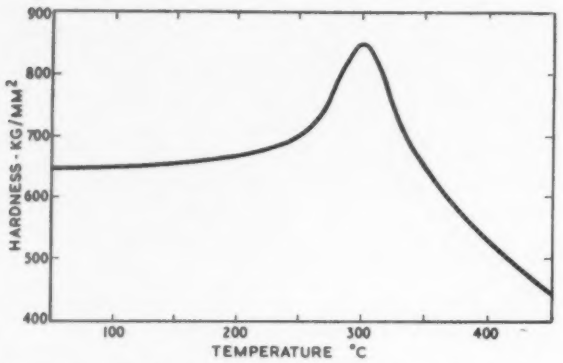
Current Density amp/dm^2	Throwing Power
1	86
5	66
10	35

TABLE II—CARBON CONTENT

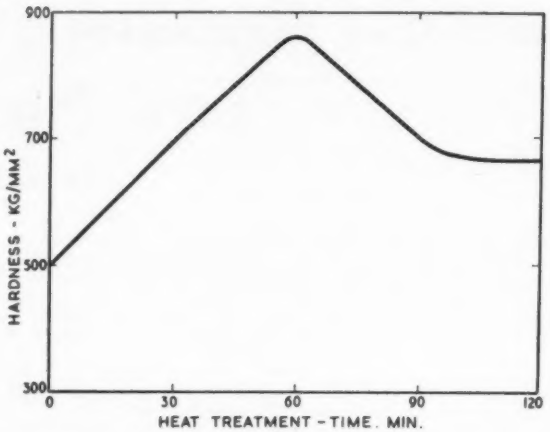
Temperature °C	Temperature °F	Carbon Content per cent
50	122	2·78
60	140	1·66
70	158	1·11
80	176	0·75

TABLE III—EFFECT ON *p*H

Current Density amp/dm^2	*p*H	Carbon Content per cent
5	6·5	0·98
10	6·5	0·86
15	6·5	0·86
5	7·5	1·38
10	7·5	0·95
15	7·5	0·65
5	9	0·73
10	9	0·73
15	9	0·72



Above: Fig. 1—Variation of nickel hardness with temperature for heat-treatment of 1 hour duration



Right: Fig. 2—Effect of heat-treatment on nickel hardness

operating conditions for getting hard nickel plating:

Nickel sulphate	140 gm/L
Ammonium oxalate	300 gm/L
*p*H	7·5-8 electro.
Current density	10 amp/dm²
Temperature	75°-80°C.

When this electrolyte is used under the conditions set forth, the rate of nickel deposition amounts to 50-60 microns/hr. (0·002-0·0024 in.); at the same time the deposits have a hardness characteristic of the order of 550-650 kg/mm².

Thus, the rate of nickel deposition in oxalic acid electrolytes exceeds five to six times the nickel deposition rate in ordinary sulphuric acid electrolytes, and the hardness of deposits is 2-2·5 times higher. The coating obtained in oxalic acid electrolytes has a smooth brightness and does not require additional brightening.

Raising of the *p*H value in the oxalic acid and electrolyte is achieved by periodic additions of ammonia.

It was established that the bright and hard nickel deposits can expediently be subjected to heat-treatment in muffle furnaces for the purpose of increasing their hardness still more. Thus, at 300°C., the hardness of the nickel deposits is raised by 200-250 kg/mm² and approximates to the hardness of chromium. It should not be overlooked, however, that further rise of temperature, as well as increase in the duration of heat-treatment can bring about a decline in the coating hardness (Figs. 1 and 2).

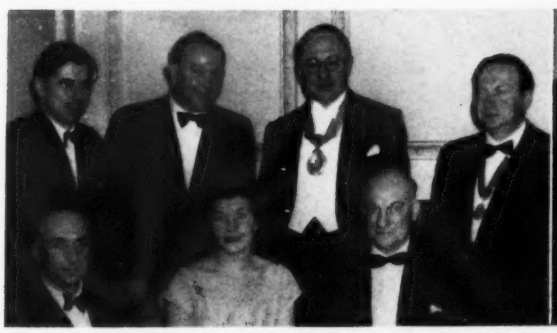
The heat-treatment appreciably enhances the corrosion resistance of the nickel deposits formed in an oxalic acid electrolyte. Without heat-treatment it is inferior to the anti-corrosive properties of deposits formed in sulphuric acid electrolyte. Moreover, the heat-treatment imparts a golden tinge to the nickel deposit.

I.M.F. Midland Branch Dinner and Dance

AT the annual dinner and dance of the Midland Branch of the Institute of Metal Finishing, held last Friday at the Grand Hotel, Birmingham, the guests were received by Dr. W. Stein, chairman of the Midland Branch, and Mrs. Stein. Among the guests were the President of the Institute, Dr. T. P. Hoar; the chairman of the Metal Finishing Association, Mr. A. Abbott; and Mr. C. Wharrad, chairman of the Midlands Branch of the Metal Finishing Association. The pictures on this and the opposite page show some of the members and guests attending this function.

Above left: Mr. C. K. Scarfe, Mr. and Mrs. R. Clegg, Mr. and Mrs. D. Haywood, Mr. and Mrs. P. Donnelly, Mr. and Mrs. T. Harrison, Miss. J. Towers, Mr. and Mrs. K. Hole, Mr. and Mrs. E. Masters, Mr. R. Marlow

Bottom left: Mr. and Mrs. A. Bissell, Mr. and Mrs. A. Abbott, Mr. and Mrs. Burns-Farquhar, Mr. and Mrs. M. Farr, Mr. and Mrs. D. Gregory, Mr. and Mrs. G. Edwards, Mr. and Mrs. J. Caldicott



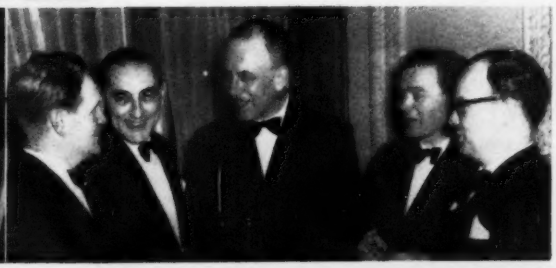
Mr. A. C. Castell, Mrs. G. N. Flint, Mr. E. J. Blewitt, Mr. G. N. Flint, Dr. G. L. J. Bailey, Dr. T. P. Hoar, Mr. H. Silman

Standing l. to r.: Mr. and Mrs. M. Yates, Mr. R. Hobbins, Mr. J. Wright, Mr. F. Tubbs, Mr. and Mrs. W. R. Parker. Seated l. to r.: Mrs. R. Hobbins, Mrs. G. Wright, Mr. W. R. Parker, Mrs. M. F. E. Fry, Mrs. F. Tubbs

Above left : Dr. and Mrs. W. Stein, Mr. and Mrs. F. Wild, Mr. D. H. Lloyd

Above : Mr. and Mrs. A. Greatrex, Mr. and Mrs. H. Wheeler, Mr. and Mrs. A. Bunting, Mr. and Mrs. W. Moorhouse

Left : Mr. G. Dance, Mr. and Mrs. A. G. Butler, Mr. and Mrs. G. Beddowes, Mr. and Mrs. J. R. Barnsley

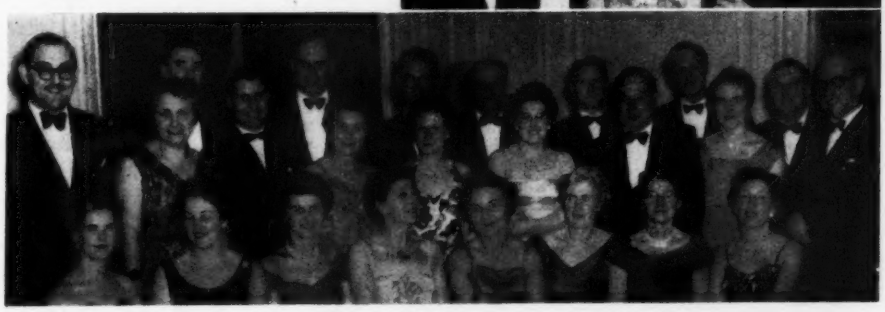


Above left: Mr. and Mrs. S. S. Chatwin, Mr. and Mrs. S. B. Gane, Mr. and Mrs. L. G. Beresford, Mr. and Mrs. M. R. Crofts

Above right: Mr. J. Weaver, Mr. W. Church-Ward, Mr. L. F. Oliver, Mr. T. I. Williams, Mr. E. E. Bishop

Right : Mr. I. T. Watkins, Mrs. Mason, Mr. W. Butterworth, Mr. A. McCandless, Mr J. Bulman, Mr. J. Plant

Mr. and Mrs. L. W. Lane
Mr. and Mrs. J. Barton
Mrs. C. H. Grant
Mr. and Mrs. B. Tromans
Mr. and Mrs. D. Paddon-Smith
Mr. and Mrs. L. G. Mummery
Mr. and Mrs. F. A. Mackay
Mr. and Mrs. J. Cooper
Mr. and Mrs. A. C. Shorthouse
Mr. and Mrs. A. F. Brockington
Mr. K. C. Jones
Miss K. Gill
Mrs. M. Gordon
Mr. T. D. Dingley



Men and Metals

Manager of the Birmingham branch office of Associated Lead Manufacturers Limited, **Mr. F. C. Rowe** retired from this position at the end of last month. Mr. Rowe joined the Cookson Lead and Antimony Company in 1935 and this company was amalgamated in the name of Associated Lead Manufacturers in 1939. Mr. Rowe was appointed manager of the Birmingham office in 1946. He is succeeded in this position by **Mr. E. E. Stenner,** who has had 40 years in the non-ferrous metals industry, including seven years with Anti-Attrition Metal Company Limited, three years with Oidas Metals Company Limited, and four years with Elton Levy and Company Limited. Mr. Stenner is now in his 27th year with Associated Lead.

It has been announced by Crompton Parkinson Limited that **Mr. G. H. Armstrong,** A.M.I.Mech.E., has been appointed chief production engineer for the southern works of the group of companies, and that **Mr. G. Cubitt-Smith** succeeds him as production engineer at Crompton Parkinson (Chelmsford) Limited.

News from West Instrument Limited is that **Mr. B. G. FitzSimon** has been appointed production engineer at the Brighton plant of the company.

Recently retired from the position of chief research engineer at the Fuel Research Station, **Mr. T. F. Hurley,** O.B.E., has now joined the National Industrial Fuel Efficiency Service. During his career, Mr. Hurley has carried out original research on a wide variety of fuel problems associated with all aspects of fuel utilization, but he is probably best known in connection with his work on pulverized fuel, and the measurement and prevention of smoke from industrial boilers.

Three directors of the Workington Iron and Steel Company have retired from that company and from the boards of the other subsidiary companies of the United Steel Companies Limited of which they are members. They are **Mr. J. N. St. George Curwen, Mr. Langton Highton,** and **Mr. D. R. Wattleworth.**

General works manager **Mr. T. Sanderson** and **Mr. J. Laird,** commercial manager, have been appointed members of the board of the Workington Iron and Steel Company.

Following the recent retirement from active duty of **Mr. J. Horridge** on medical grounds, the appointment of **Mr. J. F. Willsher** as general works manager of George Kent Limited has been announced.

It has been announced by the Steel Company of Wales Limited that **Mr. W. G. Mainwaring,** formerly deputy hot mills manager, has been appointed sheet mills manager to replace **Mr. J. H. Lysaght,** who has found it necessary to relinquish the position for health reasons. **Mr. J. M. Keefe,** former hot mills engineer, has been appointed deputy hot mills manager to replace Mr. Mainwaring, and **Mr. F. H. Holmes** has become hot mills engineer.

An announcement has been made by the Export Credits Guarantee Department that, following the retirement of **Mr. E. H. Osborne, Mr. C. P. Rawlings** will become director of its Overseas Division. At present Director of the Department's Short Term Underwriting Division, **Mr. R. A. Dickinson** will replace Mr. Rawlings as Director of the Department's General Division, and **Mr. D. A. Ward** is to assume control of the Short Term Underwriting Division.

During this present month, **Mr. J. V. Murcott,** managing director, and **Mr. P. J. Murcott,** secretary, of J. V. Murcott Limited are visiting the United States to see the latest pressure die-casting machines, with clamping forces in excess of one thousand tons.

Extrusion Die Shape

IN extrusion processes, the shape and surface finish of the die affect the dimensional accuracy and surface quality of an extruded product, and the extrusion of products of non-symmetrical section calls for much skill and experience since, among other things, it is necessary to ensure a balanced flow of metal through all parts of the die. The resistance to flow is greater in the narrower parts of the die, and if this is not allowed for correctly the product will be buckled or twisted.

The results of the first stage of an investigation of the effects of the shape of the die on the flow of metal during extrusion are contained in MERL Plasticity Report No. 127. This work may eventually lead to a more rational understanding of the extrusion of non-symmetrical sections. The flow of metal can be modified by altering the shape of the die entry to obtain the required frictional conditions, and by altering the position of the die aperture relative to the axis of the billet.

It is also necessary to balance the flow of metal when extruding several sections simultaneously through a multi-aperture die, and this has been investigated as a preliminary to studying the flow through single apertures of non-symmetrical section. With a multi-aperture die, balanced flow of metal is obtained when the velocity of each product as it leaves the die aperture is the same. When extruding simultaneously through two apertures of different size, balanced flow is obtained only if the centroid of the apertures is displaced from the axis of the billet. Tests on non-ferrous metals have shown that the conditions under which the initial and final parts of the product are extruded always lead to twisting and bending.

The report describing this work is available from the Department of Scientific and Industrial Research, Mechanical Engineering Research Laboratory, East Kilbride, Glasgow.

Standard Specifications

Aluminium - Copper - Magnesium - Silicon-Manganese Alloy Billets and Bars for Forging and Forgings. (Solution Treated and Aged at Room Temperature.) L.76: 1959. *Aluminium-Copper - Magnesium - Silicon - Manganese Alloy Billets and Bars for Forging and Forgings. (Solution Treated and Precipitation Treated.)* L.77: 1959. *Price* 4*s. each.*

FOLLOWING a recommendation that, because of differing extrusion and forging production practices, the two British Standards L.64 and L.65 should be restricted to bars and extruded stock, and that separate publications should be issued for forgings and forging stock of aluminium-copper-magnesium - silicon - manganese alloy, two new standards have been issued which in part replace L.64 and L.65.

Revisions of British Standards L.64 and L.65 will be published at a later date.

Dimensions of Blanks for Seam Welding Wheels (*B.S.*3067: 1959). *Price* 3*s.*

APPLICATION of this standard can effectively reduce the wide variety of seam welding wheel blanks which manufacturers are obliged to stock at present.

The range of diameters is 4-20 in., and the range of widths ½-1 in. There are eight preferred and five non-preferred diameters, with two preferred widths for each. The nominal metric preferred sizes have been chosen from the R.10 Series of preferred numbers and the non-preferred sizes from the R.20 Series.

Copies of the above - mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Industrial News *Home and Overseas*

Work Study

It is proposed to hold a short appreciation course of six weekly lectures on "Work Study" at the **National Foundry College,** Stafford Street, Wolverhampton, on successive Thursday evenings, commencing on April 30 next.

A prospectus regarding this course is available, and full information may be obtained on application to the Head of the College.

Tin Movements

An interesting and useful chart has just been issued by **A. Strauss and Company Limited** showing the main developments and movements in tin from July 1956 to December 1958, with estimated data for the first three months of the present year. In addition to general data, the chart shows: Russian exports, production non-I.T.C. countries, production I.T.C. countries, permitted exports I.T.C. countries, and world consumption (excluding Russia). Other details include monthly average prices and Buffer Stock purchases.

New Representative

It is reported by the Hydraulic Equipment section of **Chamberlain Industries Limited** that Mr. E. J. Hewetson, M.I.Mech.E., has been appointed to represent its activities in the Yorkshire area. Mr. Hewetson can be contacted at 9 Roger Drive, Sandal, Wakefield.

Precision Casting

A new type of investment base for precision investment casting has been developed by **Mellor Mineral Mills,** one of the Dohm group of companies. It is being marketed under the trade name of Investment Base 350.

Originally confined to the jewellery industry, the new method is now being used by a number of foundries for the production of precision castings where machining cannot be carried out, and where surface finish and tolerances are important. It was developed after extensive tests based on the original American crisobalite base.

According to the manufacturers, this new method operates at a temperature of 1,450°C. It needs no additives, retarders or accelerators, only water to mix into a slurry. Setting time is 20 min.

New Canadian Plant

An important new project has recently been announced by the Electric Reduction Company of Canada Ltd., one of the **Albright and Wilson** group of companies. A multi-million dollar expenditure is involved in the scheme, which is devised to build new plants to produce sulphuric and phosphoric acids, as well as sodium phosphates and other products. The new plants are to be located at Port Maitland in Ontario.

New Development Centre

An extremely well-equipped **Industrial Development Centre** has recently been opened at Poole, Dorset, by the Southern Gas Board. A wide range of industrial gas-fired equipment is on display in the showroom, all of which can be demonstrated under simulated factory conditions and used to carry out specific tests on individual customers' own products. A variety of burner equipment and systems for automatic ignition and control can also be shown in operation. Gas and air at both high and low pressures are on tap throughout the Centre. The workshop undertakes experimental work and the design and construction of prototype plants where this is found to be necessary to meet the problems of a customer.

An Aluminium Submarine

Recent news from New York is to the effect that the **Reynolds Metals Company** is designing an aluminium submarine which should be able to go to a depth of more than three miles and bring 60 per cent of the area of the world's ocean floors within reach. The first model of this submarine, called the "Aluminaut," may be ready for trials in a few years. It would be battery-powered, but later ones, say the company, could have a nuclear engine.

Care of Floors

On Monday of last week the Floor Care Experimental Centre was opened at the works of **Progress (Universal) Ltd.** in London. The object of this centre is to provide a practical testing centre for all types of floors encountered in offices, works, institutions, etc., and sections of such floors have been laid by twenty of the leading manufacturers. Instead of being maintained as a showroom, the centre will be subjected to the normal heavy traffic of a general office and factory.

The opening of this centre coincided with the announcement of the production in this country of the "Progress Universal," which is a unit specially designed for floor maintenance and is now made under licence from the Progress company of Germany and the Swiss patentees. The brush of this unit has a rapid oscillating motion at a speed of 2,800 times per minute. It is claimed by the makers that the action is more vigorous than that of conventional rotary units as the work is done on the tip of the bristle, with a greater ability to clean cracks, crevices and uneven floors.

The machine has only two moving parts with no gears or reduction drive, and it is claimed that 6,000 ft^2 of floor can be polished or buffed per hr., and 4,000 ft^2 scrubbed. It is light in weight, at 50 lb. for everyday duties, but additional weights can be added to bring the total to 1¼ cwt. for heavy duty work, such as removing impacted matters, scarifying or sanding.

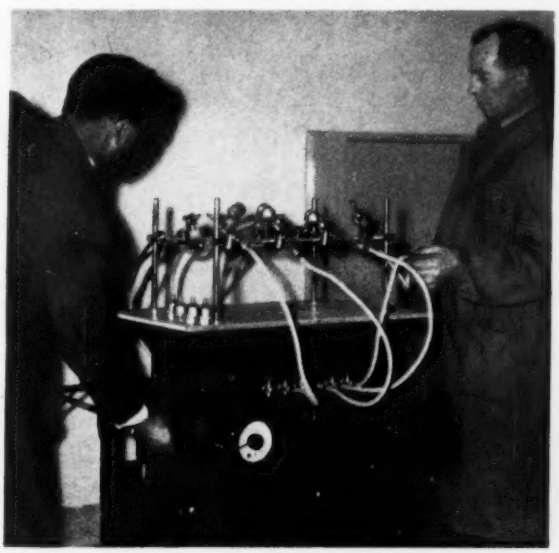
A Corrosion Meeting

On Wednesday, March 18 next, the Corrosion Group of the **Society of Chemical Industry** is holding a meeting at 14 Belgrave Square, London, S.W.1, at 6.30 p.m. for the presentation of a Paper on "Economic Aspects of Corrosion," by Mr. A. Keynes.

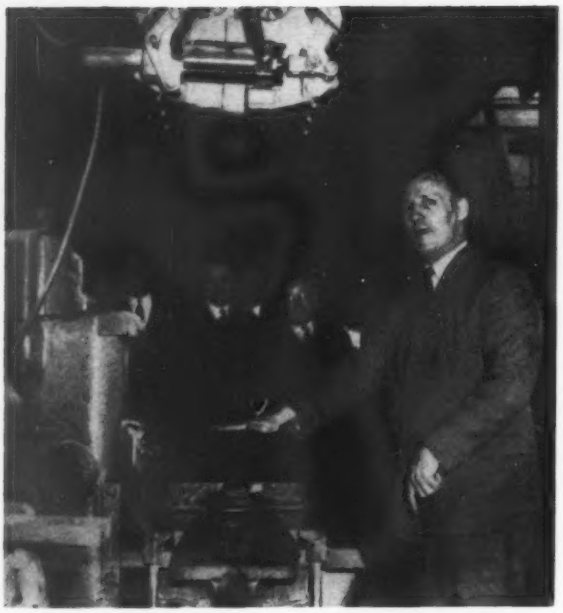
Mr. Keynes will take his main headings as follows:—Conservation aspects of corrosion control; economic aspects of corrosion affecting firms who have little or no choice and firms for whom there is a choice; techniques of choice; national economic aspect, including the balance of payments; and factors affecting investment in corrosion control—uncertainty, education, and competition.

Soviet Aluminium Plant

According to reports from Moscow, a new aluminium plant in Stalingrad will be able to produce 34 per cent more aluminium per kilowatt-hour than older refineries. The report, quoted by Tass, said the new works, which, went into production in January last, would be the largest aluminium smelter in the country by next year, when all its machinery was installed.



Mr. N. H. Greenway (industrial development engineer) and Mr. N. Dennett (foreman) adjusting an electro-gas automatic brazing unit used for repetition brazing of structural parts and assemblies, at the new Southern Gas Board's Industrial Development Centre, at Poole, Dorset



The Mayor of West Bromwich, Councillor Thomas Rochelle, who is himself a moulder, making the first production mould when he inaugurated the newly mechanized non-ferrous alloy foundry installed by Sandwell, Casting Company Limited

Foundry Mechanization

On Thursday of last week the Mayor of West Bromwich inaugurated the non-ferrous alloy foundry at the premises of the **Sandwell Casting Company Limited,** West Bromwich, which has been mechanized at a cost of some £60,000. Among the visitors present at the ceremony were representatives of firms from all parts of the country who use Sandwell products.

After the inauguration ceremony, during which the Mayor made the first production mould with the new plant in full operation, the visitors toured the works under the guidance of Mr. J. Rogers and Mr. A. H. Meese, joint managing directors of the company.

Mr. Rogers said that the installation of the new plant had involved the removal of about 2,000 tons of earth and the mixing of 700 tons of concrete. While increasing the production capacity per man, mechanization of the works had removed a great deal of the hard and heavy work previously experienced. It is expected that capacity of the foundry would now be doubled, with a reduction in the labour force of some 25 per cent. It was stressed, however, that every man displaced by mechanization had been found employment in other departments without the sacrifice of prestige or pay.

A Warning Instrument

A new warning device of the ionization chamber type which gives a loud warning on receiving a gamma dose of 30 milliroentgens is now available in portable form. It is a battery-operated pocket type unit, weighing 12½ oz., into which headphones may be plugged; it responds to beta rays, and is introduced by **Radiatron,** of Richmond.

The instrument uses transistors, and is also suitable for outdoor operation in temperate climates. The batteries have a capacity of 220 mA/hr., and as they are discharged only during the emission of the signal, and no current is drawn during measurements, they provide for two-three months' operation under normal conditions. They are recharged *in situ* by means of a small mains-operated charger, which weighs only a few ounces and can be plugged into the instrument.

This new device, which is intended to be a complementary instrument to other types of radiation protection monitors, is particularly valuable when operators are engaged on work in which their hands are not free, or where the attention or skill demanded for reading other types of instruments cannot always be depended upon.

Booklet on Titanium

A comprehensive brochure on titanium has recently been published by the American company of Harvey Aluminium. It is a 36-page booklet, and is intended as a reference for engineers, metallurgists and designers who want the latest technical information available on titanium. A free copy of this booklet may be obtained from the company at 19200 South Western Avenue, Torrance, California.

An Engineering Buyers' Guide

Covering just over 950 pages, the 1959 edition of "The Engineer" Buyers' Guide contains over 33,500 entries, arranged under approximately 2,500 classified headings with 1,500 cross references to help the user find what he wants. Names of firms, with their addresses and other information, are given in alphabetical order, and there is also a comprehensive trade names section.

The buyers' guide section is sectionized to cover chemical plant, electrical equipment, engines and engine parts, machine tools, machine tool accessories and attachments, and sheet metal working machinery. Included in other information given is a list of forthcoming engineering and industrial exhibitions, national undertakings, and details of the associations, societies, etc., connected with the engineering industry.

Eire Copper Mine

It has been reported that five directors of Can-Erin Mines Ltd. are on their way to Eire to investigate the possibility of developing a copper mine of the Bearhaven peninsula in Western Cork. The company geologist, Mr. McCannel, who is a member of the party, said before sailing from Canada: "We are convinced the mine is rich in copper. I am satisfied it will be a profitable operation within a year or two." He added that preliminary underground sampling indicated the copper might be of a quality which would fetch 50 dollars a ton.

The mine has been worked before, but work was stopped in 1884 because operations had reached a depth beyond which it was not possible to go with the equipment available in those days. If it is re-opened, it will be run by the Emerald Isle Mine Company Ltd., a subsidiary of Can-Erin, who hold the concession for its operation from the Irish Government.

Sales Conference

Last week saw the holding of the first sales conference of the newly combined **Brookhirst Igranic** organization. This took place in Bedford, and area managers and technical experts from all parts of the country were present. The opening session was attended by Sir Charles Westlake, chairman of Brookhirst Igranic and of its parent company, Metal Industries Limited.

Expansion Programme

A considerable expansion programme is at present in operation at the works of **J. V. Murcott Ltd.,** in Birmingham, following their recent acquisition of a one thousand ton pressure die-casting machine. Mr. J. V. Murcott (managing director) and Mr. P. J. Murcott (secretary) are visiting the United States this month to see the latest pressure die-casting machines with clamping forces in excess of one thousand tons.

Annual Meeting

On Wednesday next, March 11, the annual general meeting of the **National and Midland Ironfounders' Association** will be held at the Midland Hotel, Birmingham, at 2.30 p.m. At the conclusion of general business on the agenda, an address will be given by Mr. H. Woods (H.M. Deputy Chief Inspector of Factories) on "Some Aspects of Health and Safety Problems in Iron Foundries."

Arc Welding Equipment

A new manufacturing field is being entered by the **Rubery Owen Group,** which has recently formed a RowenArc Division to manufacture under licence in Britain a revolutionary type of arc welding equipment developed by the Westinghouse Electric Corporation of New York and known in America as West-Ing-Arc.

For three months a team of Rubery Owen engineers has toured manufacturing plants throughout America studying the Westinghouse system in operation, and the results of their study will be exploited at Coventry in a new RowenArc factory at Longford.

Executive establishment of this new Division includes Mr. F. Collins as chief engineer, Mr. C. J. Kemp as process engineer, and Mr. N. Schlater as production manager.

For Laboratory Use

In order that metallurgical research may be undertaken in conditions comparable with those obtaining during actual production, **Wild-Barfield Electric**

Furnaces Ltd. have received an order from The Standard Motor Co. Ltd. for a special pit type furnace for use in their laboratory.

The equipment is basically a gas carburizing furnace, model G.C.1015, but is to be supplied with an atmosphere control panel that enables gas carburizing, carbonitriding, or straight hardening to be carried out. There is, in addition, a hot oil quench tank operating at 140°-180°C. for the purpose of reducing distortion of parts treated.

Joining of Metals Conference

Advance notice is given of a one-day Joining of Metals Conference which is to be held at **Birmingham University** on Thursday, June 25 next. The subject is "The Electric Arc in Welding," and the event has been organized by the Department of Industrial Metallurgy. Applications for enrolment forms should be addressed to the Secretary, Department of Industrial Metallurgy, and an enrolment fee of one guinea will be charged, which will include the cost of lunch and refreshments.

The Department has also issued a brochure dealing with the postgraduate course, which this year, for the first time, is concentrating on "The Mechanical Working of Metals." This new course is designed for science graduates who are working in, or proposing to enter, those branches of the metallurgical industry which are concerned with metal working. The course will be of nine months' duration, leading to a Diploma in Graduate Studies, or of one year's duration leading to a M.Sc. degree. Full particulars of the course may be obtained from the Registrar, The University, Edgbaston, Birmingham, 15, and the fee (inclusive) for the course is £81. It is understood that in certain cases where a student is not sponsored by an employer, the University may consider applications for remission of this fee and, where necessary, for the grant of a maintenance allowance during the period of attendance.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses fell by 636 tons last week-end and were distributed as follows:—London 6,737, Liverpool 5,882, and Hull 1,230 tons.

Stocks of refined copper rose by 247 tons and were distributed as follows:—London 2,072, Liverpool 2,894, Birmingham 76, and Manchester 2,175 tons.

Canadian Copper and Nickel

According to the Dominion Bureau of Statistics, output of both copper and nickel in Canada were lower in 1958 than in the previous year. Copper output, at 346,816 tons, was 3·4 per cent below the 359,109 tons turned out in 1957, decreases in the final four months of the year more than offsetting increases in all previous months.

Nickel production in the 12 months dropped sharply by some 25 per cent to 140,848 tons, from 187,958 tons a year earlier. All months except January and February showed losses.

Tin from Malaya

Tin shipments from Singapore last month totalled 121¾ tons, according to the Straits Trading Company. This compared with 102 tons shipped in January. February shipments comprised: the United States 10 tons, Europe 14, Japan 10, Pacific 58¾, India 15½, and Australasia 13½ tons.

Shipments from Penang totalled 3,561¼ tons, compared with 3,370¼ in January, and comprised: the United States 2,200 tons, Europe 256½, Canada 10, Japan 617¾, Pacific 10¼, India 201½, South America 117½, Africa ½, Australasia 130, and the Middle East 17½ tons.

Japan and Aluminium

Recent news from Tokyo states that Japan's requirements of primary aluminium in the next financial year, commencing April 1, are expected to amount to 93,800 tons, an increase of 12 per cent over the estimate for the current financial year. Disclosing this, the Japan Light Metals Association said the total included 3,000 tons for export compared with 2,450 tons in the current financial year.

Total requirements of all aluminium products, including those produced from secondary aluminium, in the next financial year would probably be 139,700 tons, an increase of 13 per cent over the current financial year, the Association said.

The Association said the figures pointed to a steady rise in aluminium consumption in Japan over the past several years. During the next financial year, consumption was expected to increase, particularly for the production of household utensils, construction materials, communication equipment, cans for foodstuffs, and export goods. With domestic consumption expanding and world market prices of aluminium continuing at a low level, it would be difficult to increase exports of primary aluminium substantially during the coming financial year. The export target of 3,000 tons might not be reached, the Association added.

A Sales Tour

Among industrialists who left Britain this week was Mr. A. R. A. Hall, industrial export sales manager of **British Oxygen Gases Limited,** who is to make a tour of seven weeks of the Middle East. Among the major oil producing centres he will visit will be Qatar, Bahrein, Kuwait, Abadan, Teheran, Beirut and Tripoli. He will also visit Turkey, Libya and Malta.

School of Welding

A leaflet giving details of the next session of the School of Welding Technology has just been issued by **The Institute of Welding.** The courses run from April to October, and the subjects covered include health and safety in welding, welded structures, metal spraying, ultrasonic inspection, brazing technology and design, welded design and construction in general and mechanical engineering, advanced courses for welding engineers, welded design and construction of pressure vessels and pipework, control of distortion, residual stresses and stress relief.

The fees for the various courses vary according to the duration of each course, and full particulars of these can be obtained on application to the offices of the Institute at 54 Princes Gate, Exhibition Road, London, S.W.7.

A Spring Meeting

Two subjects of considerable topical interest will be discussed at the Spring Meeting of the **Institute of Welding,** which is to be held from April 20 to 24 this year. The first is "The Low Temperature Properties of Aluminium Alloys," and the second is "The Economics of Welding" with some emphasis on welding for the structural industry.

The meeting will open on April 20 with a reception at the headquarters of the Institute, and on the following day visits to works around London have been arranged. Technical sessions will be held on the mornings of Wednesday and Friday (April 22 and 24 respectively), and on Thursday, April 23, other works visits have been organized.

A New Metal Exchange

News from Santiago is to the effect that the Chilean authorities are planning to set up a Metal Exchange in Santiago, and a detailed study of the project is understood to be well advanced. Authoritative sources say that the creation of such a body has become unavoidable because of the increase in copper sales from the small and medium mines, and because of the recent new agreement between Caja de Credito Minero (Mining Credit Bank) and the Deutsche Affinerie of Hamburg.

Under the agreement, Caja de Credito would provide some 25,000 tons of copper annually for refining in Hamburg and for subsequent sale in Europe, all coming from the small and medium mines which are its special province. Annual output from these mines is in the neighbourhood of 40,000 metric tons in terms of metal. Early last year, emergency funds were voted by Chile for Caja de Credito to keep the mines under its care alive and prevent unemployment.

Meanwhile, the Paipote smelter is taking some of the concentrate from the Caja mines and turning it into blister at a rate of about 20,000 metric tons annually, according to Empresa Nacional de Fundiciones, which operates the smelter. Furthermore, in about two-and-a-half years a second blister copper plant, with an annual capacity of 30,000 metric tons, is scheduled to go into operation.

There is thus to be a considerable expansion in Chilean copper production, outside the large U.S.-owned mines, over the next few years, and the setting up of a Metal Exchange appears to be a logical way of handling it. A further factor in favour of the Exchange is the fact that Latin-American customers for Chile's copper—Brazil and the Argentine—have been complaining of the present system and have insisted on the introduction, in their favour, of minimum export quotas and of fixed prices.

Forthcoming Meetings

March 9—Institute of Metals. Scottish Local Section. Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2. Annual General Meeting. 6.30 p.m.

March 9 — North-East Metallurgical Society. Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough. "Development of the Tungsten Filament Lamp." B. P. Dudding. 7.15 p.m.

March 12 — Liverpool Metallurgical Society. The Library, Department of Metallurgy, The University, 146 Brownlow Hill, Liverpool, 3. "The Rare Metals Used in Atomic Energy Applications." L. R. Williams. 7 p.m.

Metal Market News

IT probably would not be wrong to say that, at least in terms of turnover, business was more active in Whittington Avenue last week than it was outside, where consumers are reported to have displayed very little interest in making any purchases. Moreover, quotations advanced, copper and tin being in the lead with quite substantial appreciation in value. The background to trading last week was somewhat disturbed in view of the state of emergency declared in Southern Rhodesia, where subversive elements have made it necessary for the authorities to go to considerable lengths in order to preserve law and order. In the States, the copper position on the supply side remains relatively tight, and the price tendency is decidedly firm. Tin also was quite strong, but neither zinc nor lead is looking very happy, and the price of the former was reduced by 50 points to 11 cents; so, for that matter was the lead quotation also, both metals standing at 11 cents. In the States, copper remained steady at 30 cents producers' price and 31 cents custom smelters, but Comex continued to move ahead, apart from minor reactions, with activity hardly diminished. Opinion about the future of the copper price continues to be on the whole bullish, and in the opinion of a good many people we shall see the custom smelters at 32 cents before long. Certainly supplies available in the States are by no means plentiful, and apparently the scrap situation is rather tight. Somewhat vague rumours have been in circulation that the import duty on copper entering the U.S.A. might be rescinded, but probably there is little truth in this.

On the London standard copper market, about 11,000 tons changed hands, with the close below the best at £240 cash and £239 10s. 0d. three months. This meant a gain of £3 5s. 0d. in cash and of £2 15s. 0d. in three months, but it will be noticed that a backwardation has again been established. However, operators are not too much worried about this, for the trend of stocks in L.M.E. warehouses seems to be upwards and at the beginning of last week it was announced that there had been a rise of 635 tons to 6,970 tons. Undoubtedly, much of the tonnage put on warrant recently has comprised wirebars, and anyone taking up copper from the market to-day would be very likely to receive a wirebar warrant. During the week, the Belgian price was advanced by 0·5 francs to 33 francs per kilo. A good deal has been heard lately about stability of copper prices and the possibility that some kind of consortium might be set up by the producers to maintain a fixed quotation. In a sense, the Belgian price is an example of this, for it operates quite apart from the Metal Exchange daily quotation and is, of course, fixed by a producer.

Stocks of tin were reported 253 tons down at 13,485 tons, and the quotation was firm throughout the week. At the close, cash stood at £781 10s. 0d. and three months at £785, these prices showing gains of £6 10s. 0d. and £7 10s. 0d. for the respective positions. The turnover was 1,145 tons. Last week the Tin Council stated that all the metal bought with the special fund has been sold. Now that the price has reached £780, the level at which the Buffer Pool manager may sell, interest is aroused at to what course will be pursued. In lead, 8,775 tons changed hands, with little change in the price on balance, while zinc was up 10s. and 12s. 6d. for the respective positions.

Birmingham

The general level of trade in Birmingham was described as static by Major C. R. Dibben, chairman of the Midland Regional Board for Industry, when he reviewed the situation recently. Unemployment is at its highest since the fuel crisis of 1947, and even though there are slight increases in activity in certain industries, some little time must elapse before this can be reflected in the unemployment figures. Many firms have put workers on short time rather than declare them redundant, and as the position improves full-time working will be resumed before any extra hands are engaged. Improvements looked for in the New Year have not yet materialized. The building trade is still slack apart from activity in the erection of commercial offices. At least three firms in the Midlands have responded to the appeal from the Board of Trade to start new industries in areas more heavily hit by unemployment.

A slight improvement in demand for light iron castings has stimulated orders for pig iron, but supplies are readily forthcoming from the blast furnaces. Sheet mills are dealing with regular deliveries to the motor car factories, and the heavy plate mills are also steadily employed. There is, however, much spare capacity in the steelworks and the foundries, many of which have been modernized to deal with a much greater overall demand. The re-rolling works are operating on short time, due to the poor market for small steel sections and bars. Very little semi-finished steel is being imported. Heavy engineering exports show some improvement, and makers of electrical engineering equipment are well employed. Industrialists are already hoping that the next Budget will bring some relief in taxation. Purchase Tax is a sore point, particularly in the motor trade, and the heavy tax on fuel oil reacts severely on transport.

Glasgow

Tool makers in Scotland are currently passing through a period of decreased demand, and in some cases it has become necessary to cut down on activity and to dismiss staff. This is regarded as a temporary situation which will adjust itself when general activity revives in engineering and metal working. The Consolidated Pneumatic Tool Co. Ltd. has currently reduced activity at their Tullos, Aberdeen, factory, and dismissed a number of employees because of decreased activity in the aircraft industry particularly. The current quietness in toolmaking has also been demonstrated at Coventry Gauge and Tool Company's Scottish factory, where production is being run down because of the decreased demand in industry in general.

Cummins Engine Company, of Columbus, Indiana, are to occupy a large-scale extension in the Shotts, Lanarkshire, factory which they took over some years ago to manufacture high horse power diesel engines. Board of Trade approval has been given for the development. The labour force employed will be nearly double.

Stage two of the reconstruction plans for their Kingston, Port Glasgow, shipyard is to be carried out by Lithgows Limited. Stage one, which cost £1½ million, was concerned with drawing office and fabrication facilities. The present stage, costing about £1 million, involves the intermediate stage of plate handling and preparation, and will include a direct flow of steel plates and bars from reception and stock yards, through shot blasting, cutting, etc., and delivery to the fabrication shops. Completion is expected after 1960.

New York

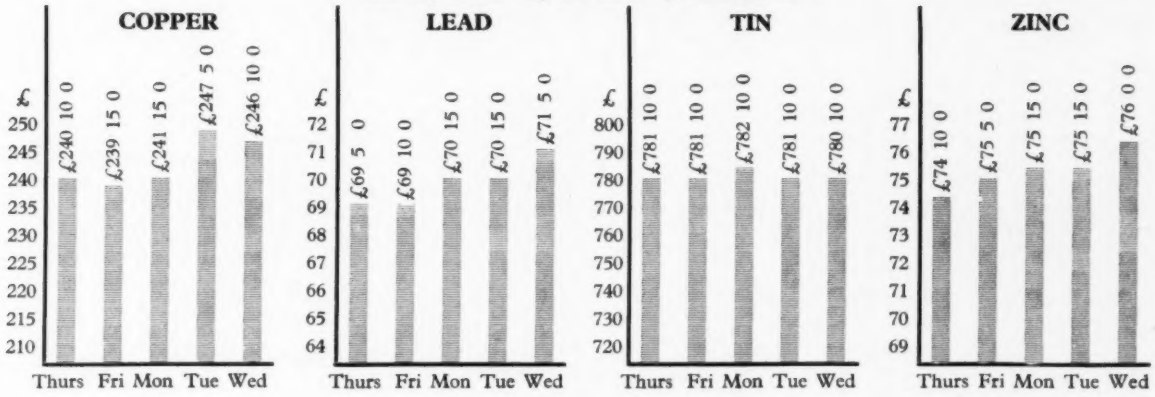
Over the week-end it is reported that copper futures were firm and active on new buying and covering. Physical copper was firm and tight. Custom smelters have little nearby copper to sell, while two leading producers are sold out for March, with the other just about sold out for that month. Trade sources said custom smelters are not too happy about the booming custom smelter market because they are having difficulty obtaining scrap at workable levels. One leading custom smelter said he would not be surprised to see the custom smelter copper price move up again soon.

Tin was quiet and steady. A fair business was reported for lead, but zinc was quiet.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 26 February to Wednesday 4 March 1959



Primary Metals

All prices quoted are those available at 2 p.m. 4/3/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite	per unit		—	
Copper H.C. Electro	ton	246	10	0
Fire Refined 99·70%	„	245	0	0
Fire Refined 99·50%	„	244	0	0

		£	s.	d.
Copper Sulphate	ton	76	0	0
Germanium	grm.		—	
Gold	oz.	12	9	5¾
Indium	„		10	0
Iridium	„	20	0	0
Lanthanum	grm.		15	0
Lead English	ton	71	5	0
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	247	0	0
Mercury	flask	74	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	5	15	0
Platinum	„	25	0	0
Rhodium	„	40	0	0
Ruthenium	„	14	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	6¾
Tellurium	lb.		15	0
Tin	ton	780	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	75	0	0
Dust 95/97%	„	109	0	0
Dust 98/99%	„	115	0	0
Granulated 99+%	„	100	0	0
Granulated 99·99+%	„	113	17	6

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏£/ton		**Canada** c/lb ≏£/ton		**France** fr/kg ≏£/ton		**Italy** lire/kg ≏£/ton		**Switzerland** fr/kg ≏£/ton		**United States** c/lb ≏£/ton	
Aluminium			22.50	185 17 6	210	157 10	375	221 5	2.50	212 10	26.80	214 10
Antimony 99.0					220	165 0	445	262 10			29.00	232 0
Cadmium					1,350	1,012 10					145.00	1,160 0
Copper												
Crude							460	271 10				
Wire bars 99.9												
Electrolytic	33.00	242 17 6	29.00	239 10	329	246 15			2.95	250 15	30.00	240 0
Lead			10.50	86 15	104	88 0	166	98 0	.87	74 0	11.50	92 0
Magnesium												
Nickel			70.00	578 5	900	675 0	1,200	708 0	7.50	637 10	74.00	592 0
Tin	113.50	835 7 6			1,111	833 5	1,520	896 17 6	9.40	799 0	104.75	838 0
Zinc												
Prime western			11.25	93 0 0							11.00	88 0
High grade 99.95			11.85	97 17 6								
High grade 99.99			12.25	101 2 6								
Thermic					110.00	82 10						
Electrolytic					118.00	88 10	171	100 17 6	.93	79 0	12.25	98 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 4/3/59

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0

†Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	—		
B.S. 1490 L.M.2 .... „	—		
B.S. 1490 L.M.4 .... „	—		
B.S. 1490 L.M.6 .... „	—		

*Aluminium Bronze			
BSS 1400 AB.1..... ton	231	0	0
BSS 1400 AB.2..... „	—		

*Brass	£	s.	d.
BSS 1400-B3 65/35 .. ton	155	0	0
BSS 249 ..... „	—		
BSS 1400-B6 85/15 .. „	200	0	0

*Gunmetal			
R.C.H. 3/4% ton .... „	—		
(85/5/5/5) ..... „	195	0	0
(86/7/5/2) ..... „	205	0	0
(88/10/2/1) ..... „	247	0	0
(88/10/2/½) ..... „	261	0	0

*Manganese Bronze			
BSS 1400 HTB1.... „	195	0	0
BSS 1400 HTB2.... „	—		
BSS 1400 HTB3.... „	—		

Nickel Silver				
Casting Quality	12% „	225	0	0
„ „	16% „	235	0	0
„ „	18% „	250	0	0

*Phosphor Bronze			
B.S.1400 P.B.1.(A.I.D. released) ..... „	287	0	0
B.S. 1400 L.P.B.1.... „	210	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ..... ton	253	0	0
15% ..... „	255	0	0

Phosphor Tin			
5% ..... „	—		

Silicon Bronze			
BSS 1400-SB1 ..... „	260	0	0

Solder, soft, BSS 219			
Grade C Tinmans.... „	364	0	0
Grade D Plumbers.. „	293	0	0
Grade M ..... „	399	6	0

Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.	—		
Type 9 „ „	—		

Zinc Alloys			
Mazak III ..... ton	107	2	6
Mazak V ..... „	111	2	6
Kayem ..... „	117	2	6
Kayem II ..... „	123	2	6
Sodium-Zinc ..... lb.		2	6½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.	2	8½	
Sheet 18 S.W.G. „	2	10½	
Sheet 24 S.W.G. „	3	1½	
Strip 10 S.W.G. „	2	8½	
Strip 18 S.W.G. „	2	9½	
Strip 24 S.W.G. „	2	11	
Circles 22 S.W.G. „	3	2½	
Circles 18 S.W.G. „	3	1½	
Circles 12 S.W.G. „	3	0½	
Plate as rolled ..... „	2	8	
Sections ..... „	3	2	
Wire 10 S.W.G. .... „	2	11½	
Tubes 1 in. o.d. 16 S.W.G. ..... „	4	1	

Aluminium Alloys			
BS1470. HS10W.			
Sheet 10 S.W.G. „	3	1	
Sheet 18 S.W.G. „	3	3½	
Sheet 24 S.W.G. „	3	11	
Strip 10 S.W.G. „	3	1	
Strip 18 S.W.G. „	3	2½	
Strip 24 S.W.G. „	3	10½	
BS1477. HP30M.			
Plate as rolled..... „	2	11	
BS1470. HC15WP.			
Sheet 10 S.W.G. „	3	9½	
Sheet 18 S.W.G. „	4	2	
Sheet 24 S.W.G. „	5	0½	
Strip 10 S.W.G. „	3	10½	
Strip 18 S.W.G. „	4	2	
Strip 24 S.W.G. „	4	9½	
BS1477. HPC15WP.			
Plate heat treated.. „	3	6½	
BS1475. HG10W.			
Wire 10 S.W.G. „	3	10½	
BS1471. HT10WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „	5	0½	
BS1476. HE10WP.			
Sections ..... „	3	1½	

Brass			
Tubes..... „	1	11	
Brazed Tubes..... „	—		
Drawn Strip Sections „	—		
Sheet ..... ton	—		
Strip ..... „	257	0	0
Extruded Bar..... lb.	2	0½	
Extruded Bar (Pure Metal Basis) ..... „	—		

Brass			
Condenser Plate (Yellow Metal)..... ton	189	0	0
Condenser Plate (Naval Brass) ..... „	200	0	0
Wire ..... lb.	2	8½	

Beryllium Copper			
Strip ..... „	1	4	11
Rod..... „	1	1	6
Wire ..... „	1	4	9

Copper			
Tubes ..... lb.	2	4⅜	
Sheet ..... ton	275	15	0
Strip ..... „	275	15	0
Plain Plates ..... „	—		
Locomotive Rods .... „	—		
H.C. Wire ..... „	291	5	0

Cupro Nickel			
Tubes 70/30 ..... lb.	3	7	

Lead			
Pipes (London) .... ton	112	5	0
Sheet (London) .... „	110	0	0
Tellurium Lead .... „	£6 extra		

Nickel Silver			
Sheet and Strip 7% .. lb.	3	8	
Wire 10% ..... „	4	2⅜	

Phosphor Bronze			
Wire ..... „	4	2⅛	

Titanium (1,000 lb. lots)		
Billet over 4″ dia.-18″ dia. lb.	63/-	64/-
Rod 4″ dia.-·250″ dia. „	75/-	112/-
Wire under ·250″ dia.-·036″ dia. ..... „	146/-	222/-
Sheet 8′ × 2′ × ·250″-·010″	88/-	157/-
Strip ·048″-·003″..... „	100/-	350/-
Tube..... „		300/-
Extrusions ..... „		120/-

Zinc			
Sheet ..... ton	110	10	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 3/3/59.

Aluminium	£
New Cuttings	145
Old Rolled	125
Segregated Turnings	96

Brass	
Cuttings	163
Rod Ends	148
Heavy Yellow	125
Light	120
Rolled	153
Collected Scrap	121
Turnings	142

Copper	
Wire	218
Firebox, cut up	212
Heavy	208
Light	203
Cuttings	218
Turnings	198
Braziery	170

Gunmetal	£
Gear Wheels	192
Admiralty.....	192
Commercial	166
Turnings	161

Lead	
Scrap	61

Nickel	
Cuttings	—
Anodes	548

Phosphor Bronze	
Scrap	166
Turnings	161

Zinc	
Remelted	56
Cuttings	52
Old Zinc	37

Financial News

Belgian Titanium Company

The Societe Belge du Titane has been set up in Brussels with the co-operation of the U.S. National Lead Company, of New York. The new firm has an initial capital of 500,000 Belgian francs, and will concern itself principally with the production and sale of titanium metal products and titanium-based chemicals.

Herbert Morris Ltd.

It is understood that the British and American shares of British MonoRail Ltd. have been acquired by Herbert Morris Ltd. Mr. Frank Morris has been appointed chairman of British MonoRail Ltd., and Mr. E. Russell and Mr. G. Randsley have also been appointed directors of the company. Mr. James Dallas, the managing director of British MonoRail Ltd., will continue in that appointment.

Philippine Copper

A new Philippine firm, the Cetson Mining Corporation, has announced the acquisition of 50 new mineral claims of copper and gold, located in Bondoc Peninsula, Quezon Province.

Evered and Co.

After tax of £126,635 (£120,531), group net profits £140,048 (£107,329). Retained by subsidiaries £7,629 (£3,609). Ordinary final dividend 6 per cent, making 10 per cent (same equivalent). Capital of business acquired during year, written off £2,126 (£12,486). Balance for reserves and carry forward £83,215 (£44,156). In view of improved trading results and to mark 150th anniversary of founding of business, directors intend to declare special distribution of 6d. per £1 Ordinary share, free of tax, payable June 1.

General Refractories Ltd.

This company and its subsidiaries show a trading profit for 1958 of £888,413 (£1,156,792), to which has been added income from investments £1,936 (£1,946), aggregating £890,349 (£1,158,738), from which amount falls to be deducted depreciation £253,976 (267,092), directors' emoluments £27,213 (£27,383), taxation on the profits for the year £305,689 (£470,203). The net profit of the group was £303,471 (£394,060). Profits attributable to outside interests £14,856 (£11,220), leaving a net profit of £288,615 (£382,840), of which £259,628 (£367,861) has been included in the parent company's accounts and £28,987 (£14,979) retained by subsidiaries. The directors have transferred to general reserve £100,000 (£191,372) and recommend a dividend of 20 per cent less tax (same), leaving £174,925 (£187,797) to be carried forward.

M. Mole and Son

Net profit 1958 £38,574 (£28,083), dividend 20 per cent (same), bonus 2½ per cent (nil) and proposed one-for-one scrip issue. Fixed assets £182,470 (£154,581), current assets £238,920 (£227,163) and liabilities £105,598 (£95,105). Reserves £188,393 (£162,140) and future tax £27,400 (£24,500).

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Catton and Company Limited (619951). Registered January 30, 1959. To take over business carried on by Weir-Catton Ltd. (formerly Catton and Company Ltd.), 29 Chadwick Street, Leeds, 10, and to carry on business of iron and steel manufacturers and merchants, metal, iron, brass, steel, stainless steel and bronze founders, etc. Nominal capital, £350,000 in £1 shares. Directors to be appointed by subscribers.

Enamel Spray Limited (620001), Crown Chambers, 118 Chancery Lane, W.C.2. Registered January 30, 1959. To carry on business of metal finishers, etc. Nominal capital, £2,000 in £1 shares (1,400 "A" ord., 300 "B" ord. and 300 "C" ord.). Permanent directors: Stanley T. E. Fiddy and Dennis Goodchild.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

West Germany (D-marks per 100 kilos):		
Used copper wire ..	(£201.10.0)	230
Heavy copper	(£201.10.0)	230
Light copper	(£166.10.0)	190
Heavy brass	(£113.17.6)	130
Light brass	(£87.12.6)	100
Soft lead scrap	(£56.0.0)	64
Zinc scrap	(£39.10.0)	45
Used aluminium unsorted	(£78.16.0)	90
France (francs per kilo):		
Electrolytic copper scrap	(£195.0.0)	260
Heavy copper	(£195.0.0)	260
No. 1 copper wire ..	£183.15.0	245
Light brass	(£116.5.0)	155
Zinc castings	(£48.15.0)	65
Lead	(£67.10.0)	90
Aluminium	(£112.10.0)	150
Italy (lire per kilo):		
Aluminium soft sheet clippings (new) ..	(£197.12.6)	335
Aluminium copper alloy	(£126.17.6)	215
Lead, soft, first quality	(£79.0.0)	134
Lead, battery plates	(£43.12.6)	74
Copper, first grade	(£212.10.0)	360
Copper, second grade	(£200.12.6)	340
Bronze, first quality machinery	(£203.10.0)	345
Bronze, commercial gunmetal	(£174.0.0)	295
Brass, heavy.....	(£138.12.6)	235
Brass, light	(£124.0.0)	210
Brass, bar turnings ..	(£126.17.6)	215
New zinc sheet clippings	(£57.5.0)	97
Old zinc	(£42.10.0)	72

Trade Publications

Oil Fired Industrial Heaters.—Simplicity Heater Company, 10a Langley Road, Staines, Middx.

A new range of oil-fired industrial heaters is introduced by this company in a neat little booklet just issued. These heaters are advocated by virtue of their extreme simplicity, and the mechanics of the heater are well within the understanding of any person in possession of the instruction book. This range of heaters is made in four sizes, from the office model, equivalent to 7½ kW, to the large unit, equivalent to 44 kW. A statistical survey of heating methods is also contained in the booklet. Copies may be obtained on application to the company.

Factory White Paint.—P. and A. New Ltd., Ditchford Mill, Wellingborough, Northants.

A useful leaflet draws attention to "Panolite," a high grade flat oil paint especially formulated to give the best possible results on a wide variety of surfaces. This paint is made in white and cream, but can be tinted to any pastel shade with oil stainers. It also complies with the Factory Acts requirements for seven-year repainting.

Films for Industry—Central Office of Information, Hercules Road, Westminster Bridge Road, London, S.E.1.

Some 612 films are listed in the new edition of this catalogue, and the list has been prepared under the guidance of an advisory panel whose members include representatives from both sides of industry, and Government Departments concerned with industry. The list covers a wide range but concerned mainly with the readers of this journal are those films which are classified under the following headings:—atomic energy, foundry practice, metal fabrication, and fuel economy. Included in this range are films dealing with brazing, cutting, powder metallurgy, soldering, welding, die-casting, melting, moulding, furnace practice, and the like.

Automatic Moulding Units. — W. J. Hooker Ltd., 239A Finchley Road, London, N.W.3.

A four-page leaflet describes and illustrates the automatic moulding units produced by Badische Maschinenfabrik A.G., Karlsruhe-Durlach, for whom Hooker Ltd. act in this country. Several of these units are now being installed in this country, as well as in Europe. These moulding plants are suitable for variant pattern moulding, for which a uniform box size can be used.

Elevator Trucks.—Powell and Company, Burry Port, Carms., South Wales.

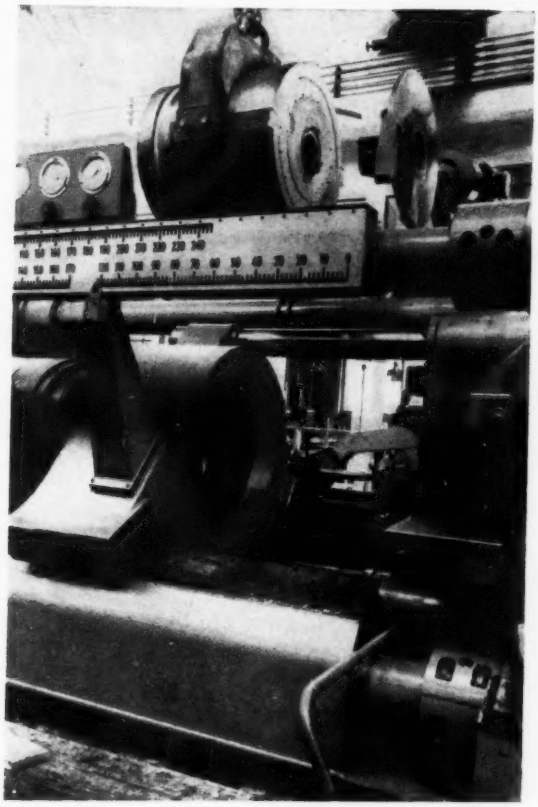
With the introduction of new 1,200 lb. and 1,600 lb. capacity models, a complete range of "Vertolifter" hydraulic elevator trucks of basic standardized design is now available, including the 500 lb. and 800 lb. models. The latest models are available in two heights of lift, namely, to 60 in. or to 75 in. They can be fitted with either fixed or laterally adjustable forks, and detachable platforms are available.

THE STOCK EXCHANGE

Some Slight Fluctuation But Undertone Remained Strong

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 3 MARCH	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	23/6	—6d.	9	10	7 13 3	24/10½	23/3	24/9	17/6
400,000	2/–	Anti-Attrition Metal	1/6		4	8½	5 6 9	—	—	1/9	1/3
41,305,038	Stk. (£1)	Associated Electrical Industries ...	54/9	—6d.	15	15	5 9 6	59/–	54/–	58/9	46/6
1,609,032	1	Birfield	56/–	—1/6	15	15	5 7 3	59/–	56/–	62/4½	46/3
3,196,667	1	Birmid Industries	74/3	+9d.	17½	17½	4 14 3	76/10½	72/–	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	36/9		11	10	5 19 9	40/4½	36/1½	39/–	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	16/3		5	5	6 3 0	16/3	15/–	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/9		6	6	6 15 3	18/1½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	27/6		10	12½	7 5 6	28/3	27/6	28/9	24/–
300,000	1	Ditto Pref. 5%	15/–		5	5	6 13 3	15/3	15/–	16/–	15/–
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6		7	7	6 16 6	—	—	20/4½	19/–
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	18/9		6	6	6 8 0	19/7½	18/9	20/–	18/4½
15,000,000	Stk. (£1)	British Insulated Callender's Cables	47/9	+3d.	12½	12½	5 4 9	52/–	47/6	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	52/3	—1/6	10	10	3 16 6	55/1½	49/3	52/–	28/3
600,000	Stk. (5/–)	Canning (W.) & Co.	25/3	+3d.	25 + *2½C	25	4 19 0	25/6	24/9	25/3	19/3
60,484	1/–	Carr (Chas.)	1/4½	—1½d.	12½	25	9 1 9	—	—	2/3	1/4½
150,000	2/–	Case (Alfred) & Co. Ltd.	5/ ½	+1½d.	25	25	9 15 0	5/2½	4/7½	5/3	4/–
555,000	1	Clifford (Chas.) Ltd.	22/9	+3d.	10	10	8 15 9	22/6	22/6	22/–	16/–
45,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 6	—	—	16/–	15/–
250,000	2/–	Coley Metals	3/–	—3d.	20	25	13 6 9	3/3	2/10½	4/6	2/6
8,730,596	1	Cons. Zinc Corp.†	62/–	+1/6	18¾	22½	6 1 0	67/6	60/6	65/3	41/–
1,509,528	1	Davy & United	96/–	+2/–	20	15	4 3 3	96/–	86/–	87/–	45/9
2,915,000	5/–	Delta Metal	25/9	—4½d.	30	*17½	5 16 6	27/–	24/1½	25/–	17/7½
4,600,000	Stk. (£1)	Enfield Rolling Mills Ltd.	45/–	—1/–	12½	15B	5 11 0	46/6	36/7½	38/–	22/9
750,000	1	Evered & Co.	31/–		10 §	15 Z	6 9 0	31/–	30/–	30/–	26/–
18,000,000	Stk. (£1)	General Electric Co.	32/–	—6d.	10P	12½		40/3	31/10½	40/6	29/6
1,500,000	Stk. (10/–)	General Refractories Ltd.	38/9	—1/3	20	20	5 3 3	40/–	37/3	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	64/–	—1/–	15	15	4 13 6	66/6	65/–	67/6	61/–
750,000	5/–	Glacier Metal Co. Ltd.	6/9		11½	11½	8 10 3	7/1½	6/7½	8/3	5/–
1,750,000	5/–	Glynwed Tubes	18/6	—1½d.	20	20	5 8 0	19/3	16/4½	18/1½	12/10½
5,421,049	10/–	Goodlass Wall & Lead Industries ...	31/3	—3d.	13‖	18Z	4 3 3	31/6	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	79/6		20	17½	5 0 6	83/9	75/–	57/9	45/–
396,000	5/–	Harrison (B'ham) Ord.	15/–	—3d.	*15	*15	5 0 0	15/3	15/–	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6		7	7	7 3 6	—	—	19/9	18/4½
1,075,167	5/–	Heenan Group	7/9		10	10‡	6 9 0	8/3	7/6	9/7½	6/9
236,958,260	Stk. (£1)	Imperial Chemical Industries ...	36/1½	+4½d.	12Z	10	4 8 6	38/3	33/9	38/–	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	16/9		5	5	5 19 6	16/10½	16/–	17/1½	16/–
14,584,025	••	International Nickel	164½		$2.60	$3.75	2 16 6	164½	153	169	132‡
860,000	5/–	Jenks (E. P.), Ltd.	9/3	—3d.	14	27½¢	7 11 3	10/–	8/9	10/–	6/7½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3		5	5	6 3 0	16/3	15/4½	16/9	15/–
3,987,435	1	Ditto Ord.	52/6	+4/6	10	10	3 16 3	52/6	44/3	47/–	36/6
600,000	10/–	Keith, Blackman	27/6		17½E	15	6 7 3	27/6	25/–	28/9	15/–
320,000	4/–	London Aluminium	5/4½		10	10	7 8 9	6/–	5/3	6/–	3/–
2,400,000	1	London Elec. Wire & Smith's Ord. ...	69/6	—1/–	15	12½	4 6 3	74/6	69/6	74/–	39/9
400,000	1	Ditto Pref.	24/9		7½	7½	6 1 3	25/3	24/3	24/3	22/–
765,012	1	McKechnie Brothers Ord.	43/3		15	15	6 18 6	45/–	43/3	45/–	32/–
1,530,024	1	Ditto A Ord.	41/3		15	15	7 5 6	43/6	41/3	45/–	30/–
1,108,268	5/–	Manganese Bronze & Brass	14/3		20	27½‡	7 0 3	14/3	13/9	14/1½	8/9
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–		7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	74/3	+9d.	11	11	2 19 3	75/–	66/6	73/3	40/6
415,760	Stk. (2/–)	Metal Traders	9/–		50	50	11 2 3	9/1½	1/6	9/–	6/3
160,000	1	Mint (The) Birmingham	22/6		10	10	8 17 9	22/6	22/–	22/9	19/–
80,000	5	Ditto Pref. 6%	70/6		6	6	8 10 3	75/6	69/–	83/6	69/–
3,705,670	Stk. (£1)	Morgan Crucible A	43/6		10	10	4 12 0	45/9	43/6	45/–	34/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/9xd		5½	5½	6 4 0	18/6	18/–	18/–	17/–
2,200,000	Stk. (£1)	Murex	45/–	+6d.	17½	20	7 15 6	48/6	42/–	58/9	46/–
468,000	5/–	Ratcliffs (Great Bridge)	10/4½		10	10	4 16 6	11/3	10/4½	11/1½	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	28/3		20	27½D	7 1 6	28/3	27/9	27/3	24/6
1,365,000	Stk. (5/–)	Serck	18/–	—1½d.	15	17½	4 3 3	19/–	18/–	18/7½	11/–
6,698,586	Stk. (£1)	Stone-Platt Industries	44/6		15	12½	6 14 9	46/9	43/3	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	16/1½		5½	5½	6 16 6	16/7½	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	82/–	+3d.	17½	15	4 6 3	83/3	72/–	86/–	48/4½
41,000,000	Stk. (£1)	Vickers	33/3	—1/–	10	10	6 0 3	37/–	33/9	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	14/9	—3d.	5	5	6 15 6	15/0½	14/7½	15/9	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	21/6	—6d.	*5	*5	7 3 6A	22/7½	21/7½	23/–	21/3
2,200,000	1	Ward (Thos. W.), Ord.	83/9	—9d.	20	15	4 15 6	87/6	83/6	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	43/9		10	10	4 11 6	47/–	39/9	46/6	32/6
225,000	2/–	Wolverhampton Die-Casting ...	9/–	+1½d.	30	25	6 13 3	9/–	8/8½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	22/6		27½	27½	6 2 0	22/6	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell	6/–		20	20	8 6 9	6/4½	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/6	+6d.	6	6	8 17 9	—	—	13/–	11/3
150,000	1/–	Zinc Alloy Rust Proof	2/9	—1½d.	27	40D	9 16 3	3/–	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting **Shares of no Par Value. ‡ and 100% Capitalized Issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ¢ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits. E and 50% Capitalized issue in 7% 2nd Pref. Shares. P Interim dividend since reduced. § And Special distribution of 2½% free of tax.



LINDEMANN

EXTRUSION PRESSES

Photo shows removal of container sleeve with intermediate bushing and liner by special lifting hook. This work is facilitated by the four column design of the press and shiftable arrangement of the container.

Sole Agents in the British Isles
MOFFAT & BELL LTD
170, Piccadilly, London, W.1
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466 Royal Exchange, Manchester 2
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Frankly the purpose of this advertisement is to bring to your notice that our prices for non-ferrous ingots of the highest quality may well be a good deal cheaper than those you are already paying—and our deliveries are exceptionally good, too. Then why the setter with philosophical doubts? Well, we thought that at first sight you might be rather more interested in her than in us. But now we have come this far together, may we send you particulars of our production facilities and details of our very keen prices?

Gold Medal Brussels World Exhibition 1958 The Engineering Centre Collective Exhibit

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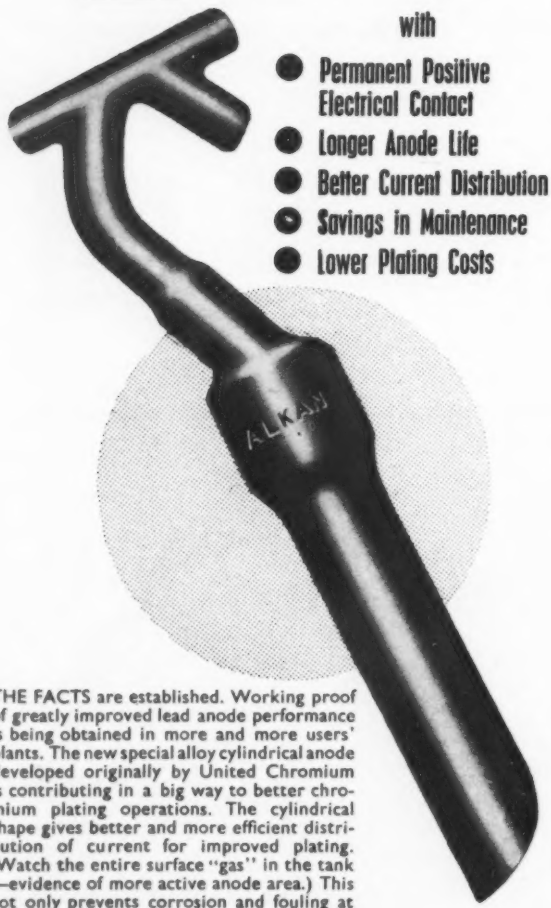

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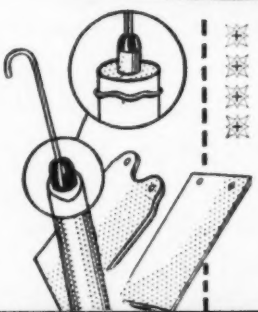

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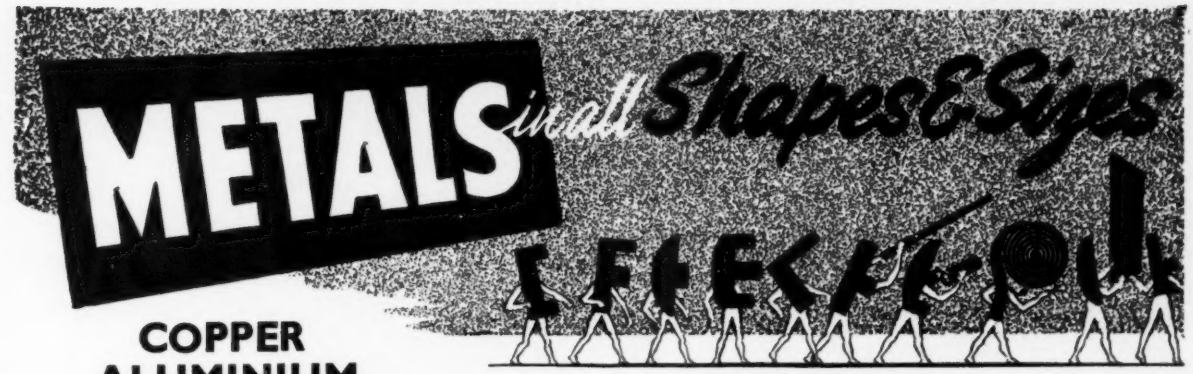

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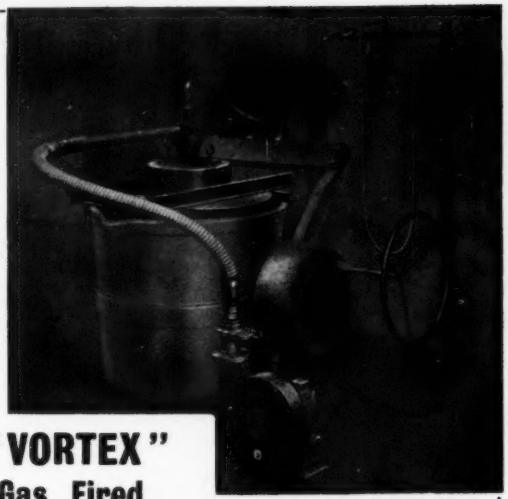

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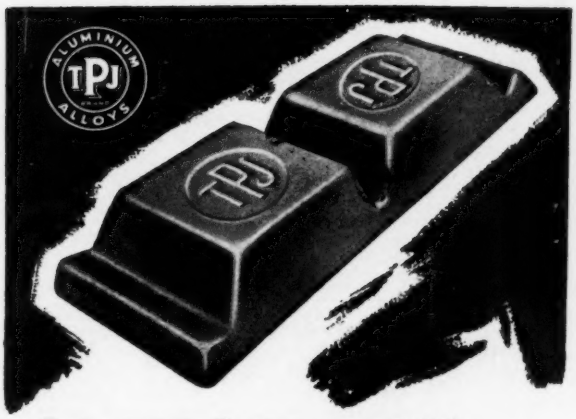

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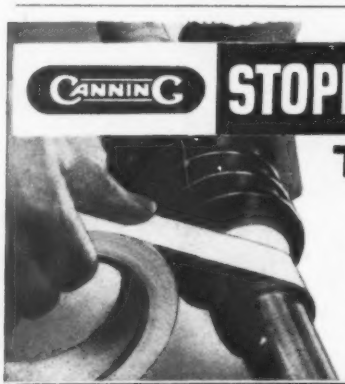

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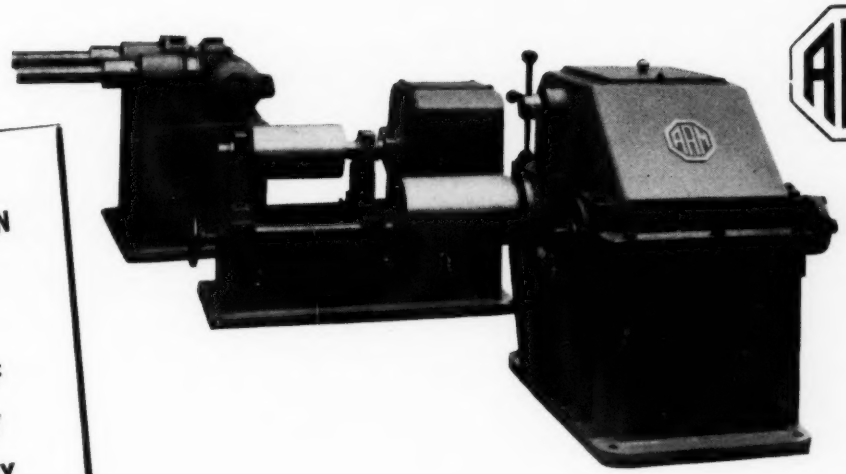

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